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The Essentials of Food

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THE ESSENTIALS OF FOOD

BY

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PREFACE.

THIS book is intended to be a correct summary of present day knowledge about foods. It is proposed to use language well within the grasp of the general reader. Necessarily many words will be used of a scientific nature, but it is hoped to explain these in plain terms. In books on foods two systems of nomenclature are used to designate food : the common or ordinary names of food, such as bread, corn, flesh, milk, fruit and any of the hundred and one words which we constantly employ when a food is named. There are other words, which are chemical in import, that are used always when the metric system is employed and these words are limited in number. There are only five of them, viz. :—Water, protein, fat, carbohydrate or starch and minerals. All food is made up of known proportions of these nutriments as they may be called, and all food is limited to the proportions it contains of these nutriments ; and when we know how much of these any food contains we then really know what a food is. As we go on with this subject we shall learn more about these things. All this will be more clearly understood when we deal with Analysis of Foods.

I am deeply indebted to many scientific men for magnanimous and kindly guidance in my efforts to obtain the best knowledge of the subject. Chief amongst these I would place Dr. Wm. Russell, of Edinburgh; Dr. Robt. Hutchison, of London; Professor Wm. Russell Chittenden, of Yale University; Dr. Rutherford Macphail, of Derby, and Dr. Philip Boobbyer, of Nottingham. Locally I have had unstinted help from the leading medical men in the town and neighbourhood in the matter of lending books and in other valuable aids to my undertaking. There are numerous others whom I wish to thank, for I have benefited often unconsciously from a great many sources.

It is thought the information in the book is a fairly complete guide to any one requiring an insight into the methods of a food treatise.

DONALD STEWART.

Aylesbury.

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THE ESSENTIALS OF FOOD.

INTRODUCTION.

It is necessary first of all to clearly understand what is the purport of the word Food. Unfortunately, in this country we do not use the metric system of weights and measures, whereas in all other countries nearly all books on the subject of Food are written in that system. When the term Food is employed, it generally is expressed in ordinary language such as oats, potatoes, beef, mutton, or some such term. In books on Food written in the metric system, the ordinary dietetic words are never used. We use instead words that signify nutrients. There are only five of these, viz., water, proteids, starches, fats, and minerals. All foods in the wide world are included in these five. The other words, such as rye, turnips, greens, convey little or nothing as to the real food value of any kind of diet. When expressed in the metric system we know what the nature of the food is, *e.g.*, fats. What the reader has to do is to accustom himself with tables of food in a Food Treatise, and he will very soon get accustomed to what is meant by the word Food. It is well to know what one is eating, whether proteid or fats, &c. That can only be learned from Food Tables.

Food must be very varied, as varied as the faces of the crowd, for every one uses food and, moreover, has his likes and dislikes. It needs no proof to say that the ignorance about the uses of food materials is everywhere very evident; no less apparent are the appalling conditions of waste and poverty amongst our populations. One need not go very far to find abundant proofs of these statements. Vegetarians tell us that even doctors are woefully ignorant of the principles of food. It is to be feared that there is some truth in the charge, for doctors are not taught anything about the uses of food in health. In disease, which they are trained to give attention to, the case is different. A medical man naturally studies the physiological necessities of the body, and those he very well understands. It is in the cases of disease that the question of food and diet comes before him. But in the matter of health, hitherto, it has been thought that any one was capable of attending to that. That is to say, the matter has been left to nature and instinct, as it has been since the days of Adam. Doctors have felt for years that there was something wrong in the dieting of the people. One here and there raised his voice against the methods prevailing, but the methods for the most part went on as they had done for ages past. At length, however, a man has arisen in the United States, Professor William Chittenden, who bids fair to revolutionize the diet of the English-speaking race. This gentleman is Director of the Scientific School of Physiology in Yale University. He experimented with three batches of men and kept records. These he published in two very well written books, viz., "The Physiological Economy of Nutrition," and "The Nutrition of Man." It is evident to any one reading these books that the results are scientifically correct. The Professor had clearly only one object in view, the discovery of truth. He concluded that for ages the standards of diet had been far too high. He did not, as one would naturally expect, carry on his experiments for merely a month or so, but went on with them for six to nine months, and having the men under his control the whole time. Moreover, the men were of the best possible classes for experimentation. These were members of the staff of Yale, including Dr. Chittenden himself; students attending the University, all athletes; and thirdly, soldiers of the United States Army. Dr. Chittenden has put it on record that one-third to one-half of the amount of proteid in the daily diet of man is quite sufficient to keep him physiologically in full health and vigour. The doctor lessened only the proteids in the diet, the other nutrients he left to take care of themselves. Further, in dieting the men, he left the men themselves to select their own diets, otherwise than in the matter of proteids. The impression prevails among doctors that, generally speaking, men are eating too much food. Dr. Chittenden proved by experiments that that general impression is a right one. It is one thing to say what the impression may be; it is another thing to know what the fact is, as every medical man, and indeed every one knows.

What, one may ask, is the consequence if men and women eat too much? This question will be answered in the sequel. Suffice it to say here that one of the problems of the present day is the amount of food that is advantageous to man to eat. The number of books on this question is legion. It may be stated to the credit of vegetarians that they have amply shown that much less flesh food is an advantage to the health of man. It was stated by the late Sir Henry Campbell-Bannerman that there are 12,000,000 in this country underfed. This statement has been frequently quoted by men of every shade of politics many times ever since, so that we may accept the fact as being very near the truth.

This makes the question of food for the masses a very serious matter, and vegetarianism does not solve the problem. Sir Henry further states that one had only to look in the faces of these millions to be convinced of the truth of the assertion. He might have added that the other 30,000,000 of our population probably ate more than they required. Twelve millions is an appalling number of people to contemplate in connection with poverty. In numbers it is larger than the population of Scotland and Ireland together at the present day, and twice the population of Canada, though Canada is filling up rapidly. These facts add a very grave responsibility to the rest of our race in these islands. When the members of the Society of Journalists visited our country in 1909 nothing impressed them so much as the numbers of poor persons in the kingdom. With all our wealth and with all our progress there is evidently much room for improvement. Here it should be stated that in this kingdom there is food enough wasted to feed these 12,000,000. This may look like a reckless statement, but let any one who doubts it enquire into the facts. This amount of waste is due in a great measure to the utter carelessness and want of thought of the people themselves.

There are many scientists who do not agree with Chittenden's conclusions. It is true not one of them has produced facts that can be fairly pitted against him. They rely on arguments and general impressions about the necessity of the people having superabundance of food at their disposal. It is not enough for them to read about the men who have tried a limitation of the amount of food thought to be required, and have found no danger to health or vigour. No doubt the truth about these things will be established by-and-by; meanwhile unbiassed men take heed to the experiments carried out by Chittenden.

Doctors know very well that numerous diseases are produced by too much food and drink. It will be seen from what follows. Many maladies arise when the purifying organs, namely, the liver, skin, lungs, and bowels, have more to do than they can accomplish successfully. It is recorded somewhere (or is it ordinary hearsay?) that it takes three generations of good feeding before a man attains to a complete standard of perfection.

Greater nonsense never was uttered! The son of a man of toil will turn up at Cambridge or Oxford and come out Senior Wrangler; another of the same rank will gain the King's prize at Bisley (in other callings the same thing often happens). Three generations of good feeding! Three months will often do it, or if it is preferred, a few years, provided the man's health has not been previously neglected.

Thousands of illustrative cases of illnesses caused by the unwise use of food and drink could be produced, as all doctors and people of common sense know; these are of every-day occurrence, giving endless work to medical men, and, what is more, providing a fertile field for every charlatan and quack in the land, and their name is legion.

Here is what Dr. Pavy, an author, and a distinguished physician of a past generation, but happily with us yet, says :—

"I may commence by saying that there is far more evil to be encountered attributable to too much food being taken than to too little.

"It is rare to meet cases of the latter kind, whilst the amount of disorder, disease, and even curtailment of life attributable to excess in eating and drinking is immeasurably great. Where the living is plain and simple, and the dictates of Nature are followed, there is no need for weights and scales; but how many are there who would not be in an infinitely better state if they lived on a weighed and measured allowance of food and drink? Were it not for the temptation to exceed, induced by the refinements of the culinary art, the physician's aid would be much more rarely required. Seeking for what is pleasurable instead of natural, the promptings of instinct are overruled, and it is the inclination instead of appetite that regulates what is consumed. Amongst the effects arising from excess in feeding may be mentioned:—Oppressed stomach, deranged digestion, a loaded tongue, vitiated secretions, disordered action of the bowels, a gorged liver, obesity, plethora and its consequences, a sluggish brain, troubled sleep, surcharged urine and its consequences, perverted nutrition, preternatural accumulation of waste products, headache, gout, rheumatism."

"Such, and others, too, are the ills arising from over-feeding." "Excess in animal food is worse than too much food of a vegetable nature." Take the case of "biliousness." There is no more common malady than this. What is the cause of it in ninety-nine cases out of 100? Or why should men and women be "bilious?" It does not require a seer to tell that, or to tell the cure for it. Every one knows the cure for "biliousness," or ought to know. The quacks know very well, and many of them make their fortunes selling the remedies for it. Common sense in the amount of food one consumes will obviate the necessity of all "biliousness" in nine cases out of ten.

There is no doubt the list of diseases given by Dr. Pavy can be amply corroborated, and is by no means overdrawn. Dr. Pavy is well remembered as one of the most noted physicians in London. It would be interesting to know whether his views on food made him unpopular, for it is well known that to put any limitations on the amounts of ingesta is to court a small number of patients. This is equal to saying that men and women, as a rule, do not relish having the amount of their food or drink limited. A few reasonable patients readily adopt a sensible diminution in the amount of food they take; but, as a rule, a doctor has to exercise all his ingenuity to succeed in getting his patients a very necessary limit to the amount they are to eat and drink. On the other hand, a "feeding" doctor is very popular; the man who orders abundance of food and drink is the man to succeed!

It must not be forgotten that the pleasure of eating is very great—so great, indeed, that it overcomes the best advice that was ever put in words. But reason should be the ground of control to the human race, and not uncontrolled appetite, nor the wily devices of the cooks. These are apt to upset the reason of the best of us. Whilst man in health at any rate, is ever ready to enjoy his food (a wise provision in Nature), and too often follows that enjoyment too far to the injury of his organization.

I.—THE BODY OF MAN, AND A GLANCE AT ITS CHEMISTRY.

This need not frighten anybody as belonging to a science beyond the understanding of the general reader, for all sciences can be made intelligible. An endeavour will be made in the following pages to explain all technical terms in plain language.

In all Nature there are only about sixty-four elements, out of which all substances in the universe are composed. An element in chemistry is the first principle, beyond which, or lower than which, it is not possible to go. The word "atom" in a chemical sense is theoretically a lower division of matter than the word "element," and every element is said to consist of a number of atoms of equal weights. I have said above there are about sixty-four elements in Nature. I have used the words "about sixty-four," for chemists are constantly finding out that there are more elements in Nature than they thought; for example, in recent years the elements "arson" and "radium" were discovered. Up to the discovery of these, they were of course included in some other element of the sixty-three or sixty-four above mentioned. Let it be clearly understood that all bodies in Nature—such as wood, hay, stubble, water, milk, and so on—are composed of a "combination" of these elements. The human body in its various structures takes up nineteen of these elements; they are these: Oxygen, hydrogen, nitrogen, carbon, sulphur, phosphorus, fluorine, chlorine, iodine, silicon, sodium, potassium, calcium, magnesium, lithium, iron, and occasionally manganese, copper, and lead. Out of these nineteen every part of our bodies is made, such as flesh, bone, hair, blood, water, and so on. When two or more elements combine, the body these form is called a compound, as fat. Fat is made up of carbon, hydrogen, and oxygen, and written thus in chemistry: CHO. There are many kinds of fat, but all fats are made up of some combination of these three elements. Similarly the composition of water is H_2O, of sugar CHO, and of hair :-carbon, hydrogen, nitrogen, oxygen, sulphur, and silicon, written thus: CHNOSuSi. The figure 2 under the H means not two "atoms" of the hydrogen, but two elements have to be taken with one of oxygen to form water.

Food is made up of some combination from the above nineteen elements. They are periodically required for the repair of the body. All the elements found in the mature body will form a part of the food some time or other. The food animals require grows on the earth, and the soil in a mysterious way can form the plants and fruits suitable for the food of animals. Man finds the food necessary for his life in the carcases of animals, as well as in plants. That is a brief way of stating what food consists of. Plants supply abundance of fruit and grains all over the world, and this brings us to give an account of all the food that man uses for his sustenance. No matter what the sort of food may be in existence, it must always resolve itself into one or other of these five nutrients (as they are called)—viz., water, proteids, fats, carbohydrates, and minerals. We shall have occasion to name these five very often in the course of this book. By general consent, based on the science of dietetics, it is found suitable to reduce all foods to one or other of these five. Whether the food may be in the form of flesh, fish, vegetable, milk, butter, or what not, in order to know its value it is necessary to know what class of these *above-named five* it ought to be named under; and most foods have examples of the whole five in their composition. We have to find out the way to divide any and every food amongst the five, as, for example, *wheat*. This is a well-known food. Chemistry divides this food into proteid, water, fat, carbohydrate (starchy food), and minerals. Whatever is beyond these in wheat is not food. To be a food it is essential that it has one quality or attribute —it must be *digestible*—not only digestible, but capable of absorption. These are attributes that all food must possess. Without these qualities the substance is not a food. Of this we shall learn more as we go on.

Here is what someone called the A.B.C. of Chemical Physiology in Foods:—

- Compounds
  - Inorganic
    - Water.
    - Salts, *e.g.*, chlorides, phosphates of sodium and calcium.
  - Organic
    - Proteins, *e.g.*, albumen, myosin, gelatin.
    - Simpler nitrogenous bodies, *e.g.*, lecithin, creatin, urea.
    - Fats, *e.g.*, fats of adipose tissue, butter.
    - Carbohydrates, *e.g.*, sugar, starch.
    - Simple organic bodies, *e.g.*, alcohol, cholesterine, vegetable acids and salts, lactic acid.

It is well to be clear about the nutrients that have been named—water, proteids, fats, carbohydrates and minerals. In some instances there are only three mentioned, I suppose from the knowledge that in nearly all foods there are examples of the whole five ; but the fifth, namely the minerals, are supplied chiefly from vegetables ; and it is well understood that man is in better health and strength when he has abundance of vegetables in his diet. Many people go for weeks without vegetables in their diet, because all foods supply minerals in more or less abundance. Hence some authors mention five nutrients, and some only four, but surely five is the right number.

The term proteid is very much to the fore in these days. The word formerly used was nitrogenous. They both mean the same thing (see pp. 46 and 47). There can be no proteid without nitrogen. The word proteid is derived from the Greek *protos*, meaning first or chief: proteid, the first or chief food. It is the chief nutrient from flesh and fish. This nutrient is by no means confined to the animal kingdom, for there are dozens of vegetables very rich in proteids, as we shall abundantly hear from vegetarians.

II.—TABLES OF FOODS.

(1) ANIMAL.

The following tables are from various sources, the chief source being Dr. Robert Hutchison's book on "Food and Dietetics"

(Arnold, London), a veritable mine of knowledge on the subject:—

	Water	Fat	Proteid	Ash or Minerals
Beef (medium)	76·5	1·5	20·0	1·3
Mutton ,,	65·2	19·5	14·5	0·8
Veal ,,	71·0	17·0	11·0	1·0
Lamb ,,	63·5	16·5	18·5	1·1
Pork ,,	44·4	45·5	9·7	0·4
Bacon	22·3	65·2	8·1	4·4
Hare	74·0	1·1	22·3	1·1
Rabbit	66·8	3·1	21·4	1·0
Venison	75·7	1·0	19·7	1·1
Fowl	70·0	3·1	23·3	1·0
Wild duck	70·8	3·0	22·0	1·0
Goose	38·0	45·5	15·9	0·4
Pigeon	75·1	1·0	22·1	1·0

(1*a*) Organs Chiefly.

	Water	Fat	Proteids	C.H.	Ash	Salt
Kidney	76·7	4·8	16·9	0·4	1·2	—
Liver	71·2	4·5	20·7	1·5	1·6	—
Heart	62·6	20·4	16·0	—	1·0	—
Sweetbread	70·9	12·1	16·8	—	1·6	—
Blood	80·8	0·2	18·1	—	0·85	—
Tripe	74·6	8·5	16·4	—	0·5	—
Tongue	71·5	5·5	20·0	—	1·3	—
Brain	80·6	9·3	8·8	—	1·1	—
Foie gras	46·04	33·59	14·59	—	3·11	·22
Potted beef	32·81	44·63	17·17	—	2·03	—
Sausage	54·99	21·04	12·28	1·5	3·52	—
Polony	45·57	32·66	17·26	2·30	2·80	—

(2) Fish.

Analysis of Cooked Fish.

Kind	Waste	Gelatin	Water	Nutrients
Herrings	11·74	0·63	52·99	34·54
Sprats	17·90	0·90	61·5	19·70
Salmon	5·99	5·53	61·06	32·02
Trout	8·23	0·55	67·12	24·10
Eels	11·66	1·09	53·29	33·96
Mackerel	10·51	0·25	65·21	24·03
Cod	15·99	0·43	63·78	19·79
Haddock	35·10	0·80	46·46	17·64
Whiting	21·10	0·86	61·29	16·35
Turbot	31·20	0·59	53·09	15·12
Salt herring	—	—	46·03	34·54
,, cod	6·13	0·33	67·68	25·86
Halibut	6·84	0·03	69·35	23·78
Plaice	—	—	79·86	20·14
Soles	22·02	0·74	61·18	16·06
Lemon soles	26·17	1·42	56·56	15·85
Smelts	18·86	0·38	65·20	15·56
Red mullet	24·28	2·41	50·05	23·26
Roach	24·36	0·65	56·52	18·46
Tunny	—	—	63·49	36·51
Hake	7·84	0·26	78·01	13·89
John Dory	20·91	0·98	60·82	17·29
Brill	8·19	0·19	57·49	34·13
Oyster (shell contents)	—	—	77·21	22·29

Mussels, clams, periwinkles, scallops, and other molluscs are very similar to the oyster.

REMARKS ON THE TABLE OF ANIMAL FOODS.

It will be noticed that in the flesh table the columns for carbohydrates are for the most part left blank. Of course there are no carbohydrates or starches in animal foods. The term proteid applies chiefly to animal food, though it is necessary to remember that there are many samples of proteids amongst vegetable foods, as for example in the pulses, in many of the stronger cereals and in nuts. Proteids from flesh are the most easily digested of all foods. One often hears from doctors that flesh and fluids made from flesh are not foods but stimulants. It causes wonder to hear such statements, but on being inquired into particularly, and in the light of science, the statement is admitted to be quite true. A little thought will reveal to anyone the great probability of the truth of the statement, for flesh is a product already engaged in the duties of the highest organizations we associate with life : quite different therefore from vegetables, seeds, nuts, and fruits, which have the growth of future crops involved in their organization. Then we know that flesh food acts as a stimulant on those not accustomed to its regular use. Vegetarians amply support this view of fleshy foods. It is further remarkable that the proteids of animal foods exercise a far more potent influence on the tissues and health of man than food (any food) of vegetable origin (see pp. 99-110). The juices, as such, of flesh are worthy of these remarks a thousand times more than the solid flesh foods. The juices of flesh carry with them the flavours that are so highly valued in flesh. It is well known that the market is flooded with concentrated preparations of animals. They are all highly flavoured : indeed, this is their chief virtue, and upon them particularly the flavour of the original flesh depends. They are called very often *extractives*, because all the juices are extracted from the flesh and conserved in these preparations. They are of no value as nutritives, though the makers extol their virtues highly. They are stimulants, as above mentioned. Their chief virtue lies in their flavour, and for that people with long purses do not grudge to pay high prices for them. The writer has given an analysis of these (p. 31).

These remarks apply to fish also. It is well known that the use of fish does not entail the same encumbrance on the digestive organs or the same work on the organs that discharge the waste products, as foods derived from flesh. That is to say, fish is a lighter food, and is more easily digested ; and, moreover, no one ever blames fish for conveying tubercle (consumption) to man. Fish, on account of the smaller amount of proteid present, is a much lighter and safer form of nitrogen than that derived from flesh food. Chittenden in his experiments lessened, it will be remembered, the amount of proteids only in the food of the persons undergoing the experiments. The amount of carbohydrates in the food was not interfered with. It is this question of flesh proteid that is detrimental, or thought to be detrimental, to the welfare of health. As far as one can judge, by the use of fish instead of flesh, the chances in favour of future health are much greater in the case of the fish proteid. The list of diseases which Pavy gives as caused by the clogging of the system with the waste products of flesh foods is appalling (see p. 9. There is very little doubt that the opinion of Dr. Pavy is a correct one, and one is safer to go by it until more reliable knowledge is established (if ever).

Fish.

Inasmuch as isinglass is the purest form of jelly, and this substance is obtained from the swim bladder of fish (especially the sturgeon), this is the natural place to say a word or two on jelly and fish.

Fish is admitted, on all hands, as a very nutritious form of proteid. It seems to rank as an inferior food to that of flesh. Perhaps salmon is an exception to this statement. White fish is more easily digested than other kinds. Cod is an exception to this statement and mackerel too; the former owing to its thick fibres being hard to digest, though a white fish; the latter, according to Chittenden and Cummins, not being quickly dissolved. Everyone should remember whiting as the "chicken of the sea" as recommended to the dyspeptic. Frying is a more profitable way of cooking fish than boiling, owing to the extraction by the water of the bases of jellies from the fish in the process. It is popularly thought that fish is the food for the brain, and that it is also a stimulant of the reproductive organs. There is no scientific ground for either conclusion. The French have debarred fish from the diet of inmates of the St. Louis Hospital for Diseases of the Skin, thus admitting that fish may be the cause of some skin affections. In estimating the economic value of fish, one should remember the great waste in all kinds of fish; this, with the market price which is ruled often by the fashion of a place, makes the price of ordinary fish dear. The cheaper kinds are, as a rule, the more nutritious and economical. For instance, canned and tinned fish have no waste, and salted fish is cheap. The despised bloater is a cheap kind of nutriment; two salted herrings will supply sufficient proteid for an adult for twenty-four hours. *Caviare* is made from the roe of the sturgeon. It should be greyish in colour—not black—and the separate eggs quite visible. *Milt*, the organ in the male fish, may be regarded as similar in composition to *caviare*.

There is a powder called *marvis* sold by the Patent Fish Food Co. (Greenock, N.B.) It is white and of a high nutritive value.

Shell-fish on the market are lobsters, crabs, clams, mussels, periwinkles, scallops.

The *green turtle* is the only reptile used in this country for making turtle soup. *Mock turtle* is made from the gelatinous substance in the scalp of the calf.

	Potted lobster	Tinned lobster	Crab	Oyster	Other shell-fish
Water	51·33	77·8		87·3	
Proteid	14·87	18·1		6·1	
Fat	24·86	1·1	Same	1·4	Same
Nitrogenous			as		as
substances ...	4·04	0·6	lobster	3·3	oyster
Ash (salines) ...	4·90	2·4		1·9	
	100·0	100·0		100·0	

The oyster is a popular article with some people and it may be said to be largely eaten. It is not a very nutritious article of food, though it has a big reputation for deliciousness. Fourteen oysters are equal to one egg (Hutchison). One man is said to have eaten one gross of them followed by a heavy dinner! They must be easy of digestion in the raw state. Oysters have lately had the reputation of carrying the germs of typhoid fever, and many people are very prejudiced against them. All the nutritive elements required by man are said to be present in the oyster. The greening and fattening of oysters seem of a very doubtful nature, and uncertain in their bearing regarding their advantages in improving the oyster as a food.

The sources of jelly are calves' feet and the connective tissue of young animals; for example, veal. The albuminoid of connective tissue is called collagen, which yields *gelatin* on boiling. Jelly is not in itself a nutritious form of food, though it is pleasant in illness and convalescence. It is one of our best *protein sparers* and is of much use in acid dyspepsia. It is said that one per cent. in water is enough to make the water set, and two per cent. is equal to about an ounce to the quart. It is valuable also as a pleasant vehicle of sugar. Gelatin contains about 84 per cent. of albumen; jelly may or may not be a gelatin. Nelson's or Cox's gelatin is very much more economical than buying isinglass.

Extracts of Beef.

	Proteids	Water	Extractives	Non-nit.	Minerals
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Liebig's Extract ...	9·45	18·35	29·67	18·85	23·68
Bovril, fluid beef ...	3·84	38·10	12·04	19 75	17·87
,, Invalids	8·19	21·67	16·13	29·23	16·82
Brand's Bouillon... ...	5·73	36·27	19·34	19·75	15·17
,, Essence... ...	10·4	87·17	1·01	—	1·39
Mason's ,, ...	3·03	77·07	7·47	1·58	9·51
Bouillon Fleet	11·81	61·95	9·87	3·81	12·50
Armour's Extract ...	10·89	15·85	43·23	25·91	2·63
Oxine's ,, ...	13 0	62·9	4·54	—	19·60
Vejos ,, ...	19·35	25·02	21·02	17·09	14.0
Viking Essence	3·63	90·68	1·85	2·41	1·43

Beef Juices.

	Proteids	Water	Extractives	Non-nit.	Minerals	
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	
Valentine's	9·65	51·21	11·16	—	10·84	
Brand	15·45	59·15	16·55	—	8·85	
Lipton	22·13	42·91	18·70	—	16·26	
Burgoyne	13·0	49·51	8·10	—	14·20	
Esco	7·6	52·43	5·90	13·66	20·39	
Wyeth	38·01	44·87	—	—	17·12	
Armour	8·3	74·10	9·54	—	7·51	
Bovril	7·23	52·01	14·03	20·76	5·97	
Bovinine	13·32	78·42	0·55	6·01	1·60	
Puro	30·33	36·6	19·16	—	9·79	
L. Carnis	6·96	56·06	5·01	28·42	3·55	Albn. 11·0
Natural Beef Juice ...	5·18	90·0	3·56	—	—	
Leube Rosenthal ...	6·51	67·51	7·55	5·93	1·80	
Beef tea	7·6	75·00	2·1	—	0·68	

Powders.

Pemmican = A Powder.
Somatose = A Powder.
Mosquera = Beef meal.

III.—MILK AND MILK PRODUCTS.

VARIOUS ANALYSES (HUTCHISON).

	Proteids	Water	Sugar	Fat	Salts	Alcohol	Lactic acid
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Cow's milk ...	3·5	88·0	3·0	4·50	0·7	—	—
Whey ...	0·82	93·64	4·65	0·24	0·65	—	—
Cream ...	4·0	33·0	3·75	7·5	0·64	—	—
Butter ...	2·0	12·8	2·0	82·0	0·5	—	—
Margerine ...	1·3	9·3	?	82·7	6·7	—	—
Butter milk...	2·63	90·0	3·9	1·45	0·6	—	0·3
Koumiss ...	2·2	88·0	1·5	2·1	0·9	1·7	0·9
Keppir ...	3·1	87·0	1·6	2·0	0·8	2·1	0·8

Cheese.

	Pro-teids	Water	Sugar	Fat	Salts	Price	
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	s. d.	s. d. Per lb. of nutriment.
American ...	32·9	26·9	—	31·0	4·5	0 6 per lb.	0 8½
Brie	18·9	49·7	—	26·8	4·5	—	—
Camembert ...	21·0	48·6	—	21·7	4·4	0 6 (11 oz.)	0 8½
Cheddar ...	33·0	31·9	—	26·8	3·9	0 9½ per lb.	1 2
Cheshire ...	29·4	33·2	—	30·7	4·3	0 9½ ,,	1 2
Cream cheese	8·6	32·0	—	35·9	1·5	—	—
Dutch ...	30·8	32·9	—	17·8	6·3	0 7 ,,	0 10½
Gloucester ...	36·7	31·9	—	24·7	4·4	0 9½ ,,	1 2
Gorgonzola ...	25·9	39·2	—	26·9	4·7	0 9 ,,	1 3
Gruyère ...	31·5	34·1	—	28·2	4·0	0 10 ,,	1 3
Neuchatel ...	14·3	41.0	—	43·2	1·4	—	—
Parmesan (goat)	43·8	30·0	—	16·5	5·9	0 11½ ,,	1 4½
Roquefort (ewe)	34·8	25·1	—	31·5	5·5	1 1½ ,,	1 6½
Stilton ...	23·9	27·6	—	38·9	3·1	1 2 ,,	1 7

Other Milks.

	Pro-teids	Water	Sugar	Fat	Salts		
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.		
Human ...	1·7	86·7	6·2	3·4	0·2	—	—
Cow (above)	3·5	87·5	4·9	3·7	0·7	—	—
Goat ...	4·50	85·50	5·80	4·10	—	—	—
Sheep ...	8·00	82·00	4·50	6·50	—	—	—
Ass	1·70	90·50	6·40	1·40	—	—	—
Mare ...	1·62	89·33	8·75	0·20	0·5	—	—

Milk is the most wonderful food the world possesses. It is true it is in liquid form, but the assertion is nevertheless correct. It contains in its composition almost all the elements of a perfect food and it has examples of all the nutrients, *e.g.*, proteids, fats, carbohydrates, salines and water. There is indeed one element that milk is short of, namely, iron, and babies and adults who are long confined to milk food by itself are apt to become anæmic. It is invaluable as a food in disease, for when one is too ill to eat, it is nearly always possible to drink. Milk is used by peoples all over the world. As a supplementary food for those requiring to " feed up " milk has no equal ; and cream, a well-known constituent of milk, is universally regarded as a luxurious addition to the diet table. This ingredient forms a peculiarly advantageous *emulsion* ; for the chemist can hardly form a finer emulsion than cream, which is said to contain in one drop the size of a pin head, 1,500,000 globules. The proteids of milk are in the form of casein and another albuminous body called lact-albumen. These two bodies are by no means similar. It is not yet agreed how these albumens can be properly treated. This fact, as fact it is, to the writer's mind is wonderful after 6,000 years of experience of milk by the human race. The difficulty arises over the peculiar relations of the salts of lime in milk. This is shown by the manner casein is formed in the stomach. When milk is swallowed, it is coagulated by the action of rennin, provided there is present enough phosphate of calcium. This clot is practically a new substance with new qualities. The lact-albumen is said to be precipitated (not coagulated) by the lactic acid present in sugar of milk (lactose) and acted upon by micro-organisms. The clot casein is digested like any other proteid. The precipitate lact-albumen produced by lactic acid is a flocculent body and produced by the action of the acid on the lime salt in its association with the casein. There may be thus two bodies present in the stomach at the same time, and it is this combination that creates the misunderstanding in the minds of physiologists. Outside the stomach casein is differently controlled, as makers of cheese well understand.

The following is Dr. Pavy's analysis of one pint of milk. In view of the enthusiasm now-a-days about the weighing of all foods, a high value ought to be put on this analysis. Weight of one pint of milk is 9,012 grains.

	Grs.	Ozs.	Per cent.
Nitrogenous matter ...	369	0·843	4·1
Fat	351	0·802	3·9
Lactine	468	1·069	5·2
Salines	72	0·164	0·8
	1,260	2·878	14·0
Water	7,752	17·720	86·0
Grains ...	9,012	20·598	100·0

IV.—EGGS.

	Shell	Water	Nitrogenous matter	Fat	Ash
Composition of the whole egg	11·2	65·5	13·1	9·3	0·9 = 100
Composition of edible parts	—	73·7	14·8	10·5	1·0 = 100
Composition of lean meat (moderately)	—	73·0	21·0	5·5	1·0 = 98·5
Proportions: Shell 10 parts, white 30 parts, yolk 60 parts					= 100
Composition of white of egg	—	85·50	12·87	0·25	0·63 = 99·23
Composition of yolk of egg	—	51·03	16·12	31·39	1·01 = 99·55

(Ash of the whole egg: Konig.)

	Yolk	White
Potash	9·20	31·41
Soda	5·87	31·57
Calcium	13·04	2·78
Magnesium ...	2·13	2·79

	Yolk	White	
Iron	1·65	0·57	(From Hutchison.)
Phosphates, &c. ...	65·46	4·41	
Sulphur	—	2·12	
Fluorine	0·86	1·06	
Chlorine	1·95	28·82	

This is the most remarkable production in Nature. It is the only single article that can supply all the essential nourishments for the whole animal body. Milk comes very near to do the same, but it cannot be said to form a complete food; this the egg can be said to do. No wonder then that the egg is a highly esteemed article of diet. It is a nutriment that should always be remembered in the food of the young and growing population everywhere. It is true that its richness prevents its being universally used, but its importance no one can doubt. There is an idiosyncrasy in some persons that prevents them taking eggs, and in some, sulphuretted hydrogen is developed if they touch eggs, but these cases are rare. The writer well remembers the grand old veteran, Jonathan Hutchinson, telling the Medical Society of Nottingham once that if we failed to cure indigestion, to stop eggs. One is reminded that in the human body there are nineteen elements of chemistry, and eggs contain thirteen or fourteen out of these nineteen. It is no surprise to hear then that all the essential elements are contained in the egg for rearing the chick until it is hatched.

Reference to the tables will give all the information necessary about eggs. Everyone should know that the yolk is more nourishing and more easily digested than the white, and that the white consists of pure albumen. There is no better way of cooking an egg than by lightly boiling it in the shell. The beating up of the white is a most beneficial help towards its digestion (p. 30). Any further information about eggs can be had in that mine of knowledge, Dr. Hutchison's "Food and Dietetics" (Arnold, London).

V.—DIGESTION.

The first and most important thing to consider in digestion is mastication. Of course, one naturally thinks of the teeth in this connection, and the whole question is included in the phrase "Mouth Digestion." That there is a mouth digestion one should always remember. The starchy part of the food is here subjected to the first change, whilst it should always be recollected that all parts of our food are here subjected to that invaluable process of trituration. In order to be clear as to what our diet should consist of, allow the writer to repeat here the several parts of a standard diet. This consists of about 120 grm. proteid, 161 grm. fat, 454 grm. carbohydrates ; total, 735 grm.

We see that carbohydrates or the starchy parts constitute more than half the amount. All this gets its first impulse towards full digestion in the mouth, for here it encounters the saliva, which with the aid of the tongue, teeth, lips and muscles of the mouth and the ferment ptyalin converts most of the starch into a sugar ready for the next stage, namely, absorption. It, the starch, is not all converted into sugar ; what escapes digestion in the mouth is completed, not in the stomach, but in the intestines, as we shall afterwards see. Those who chew best and give the necessary time to mastication get the most value out of the food, and they escape possible trouble as digestion goes on. A witty American says to those who would think over the process of digestion: "Remember there are no teeth in your stomach"! Cato's saying should also be recorded here: "You cannot argue with the stomach, for it has no ears." The teeth, therefore, should be used effectively, and one should be taught how to use them; moreover they should be taken care of. There is no better friend to the teeth than the tooth-brush, this instrument should be used regularly. If the tooth-brush were in evidence oftener, we should hear less of abscesses and other evils in the mouth. The teeth are benefited by exercise on hard, dry foods, but they should never be used over hard, unyielding matter, such as cracking nuts. The food should be fairly and sufficiently masticated before being swallowed, and one should avoid washing down each mouthful with a drink—a very faulty habit, besides being detrimental to the success of proper mastication. We have all heard of Gladstone's thirty-two bites to every mouthful? There are several authors living who have made a special study of mastication, and they are glad to quote the "Grand Old Man" as one who was aware of the importance of thoroughly chewing the food.

The glands concerned in salivation are the parotid (near the ear), the submaxillary (under the jaw), and the sublingual (under the tongue), and numerous small ones in the mouth. As soon as a person is presented with food these glands pour out abundance of fluid suitable for the kind of (Pawlow) food, and prepare the mouthful for deglutition. Moreover, there is an enzyme or ferment supplied by the salivary glands called ptyalin (chiefly by the parotid—the late Henry Power, M.B.Lond.), which converts the starchy foods into dextrins and maltose, or, in other words, *starch* into sugar. The word enzyme simply means ferment. We must use the word fermentation very often; it is highly necessary that the process should be clearly understood, for, as far as we at present know, the whole process of digestion is a fermentation (see p. 91). There is not a brewer or a baker in the land but is familiar with fermentation.

The process of swallowing is very soon over as a rule, and on arriving in the stomach there is no more change in the carbohydrates that have escaped being made into sugar by the action of saliva till they arrive in the duodenum or first part of the intestine. No doubt such parts of the carbohydrates as are completely changed into sugar and ready for absorption are absorbed in the stomach, or pushed on through the pylorus. It may be stated here that the stomach is the great seat of the digestion of proteids, or the flesh-forming division of foods. The products of mouth and stomach digestion are named "chyme" as they pass through the pylorus, or gateway between the stomach and intestine. On arriving in the duodenum many ferments from the pancreas, the liver, and from the intestine itself meet the food ("chyme"), and digestion of all the foods hitherto undigested proceeds. As the food becomes ready for absorption it is called "chyle" or lymph, and that is the name given to the contents of the lacteals. The latter are also called lymphatics. Many people have never heard of these vessels. We have heard of arteries and veins often, but hardly ever of lacteals. They are not visible to the naked eye. Their function is to gather up the foods that are ready for absorption, and the cells that have served their purpose in the body, and convey them to the blood through the "thoracic duct," which enters at the junction of subclavian and jugular veins, and so joins the blood-stream. That is a short reference to a set of vessels that are most important in the process of digestion, and involve the most interesting and profound questions in physiology.

The proteins on entering the stomach are met by the ferments, pepsin and hydrochloric acid. Pawlow, the great Russian investigator, says the gastric juice suitable for the digestion of the kind of food given is poured out! The acid medium in the stomach is unfavourable to any further action on starch by the mouth ferment, ptyalin, which must have an alkaline or neutral medium for its natural effect. The proteids are the most easily digested of all foods, and are chiefly digested in the stomach. The process of digestion is very complicated and mysterious, as we shall see in what follows. The first real insight into the physiology of digestion was obtained when the Canadian hunter, Alexis St. Martin, had a gunshot wound in the abdomen, and

Dr. Beaumont investigated the case. This case has been quoted ever since in every book on physiology, although it is only about a hundred years since it happened. There are glands all over the stomach concerned in digestion; they are named cardiac, central, and pyloric, from their locality; and oxyntic (acid-forming) from their function. The most important substance is pepsin, or its precursor pepsinogen. The rennin that curdles milk in the stomach (or out of it) is secreted from the same cells that supply the pepsin, although it is right to mention that some say there is no such thing as rennin (Pawlow's opinion) secreted, and that the curdling of the milk is brought about by pepsin. Let it be observed that the blood is an alkaline fluid, and the lymph is alkaline, yet by a complicated chemistry, which physiologists explain, the chief secretion in the stomach is an acid—the hydrochloric acid of digestion. Pepsin stands apart from all other ferments in requiring an acid medium for its action. The amount and strength of the gastric juice is in proportion to the food supplied, and its necessities as mentioned above (Pawlow). The juice is antiseptic, inverts cane sugar into dextrose and lævulose: in this the gastric juice is assisted by ferments in the food and by lipase, a fat-splitting ferment. The clot of milk is digested like any other protein solid. The gastric juice is said to be hydrolytic (loosening with water), and proteolytic (loosening proteids). This is said to be the most important function of all, for by it the proteids are split up into a vast number of bodies, all of them named and all of them of a nitrogenous nature, ready for absorption. As digestion is completed in the stomach, gushes of foods are ejected through the pylorus by the muscular actions of the walls of the stomach and the chyme appears in the duodenum, there to meet the ferments from the pancreas, the liver, and the glands in the lining membrane of the duodenum itself. The pancreas is stimulated to secrete its ferments by the acid thrown into the duodenum from the stomach, although the ferments from the pancreas are in an alkaline medium. The pancreas ferments are:—

Trypsin, a proteolytic ferment, or proteid-splitting.

Amylase, a starch-splitting ferment.

Lipase, a fat-splitting ferment or enzyme.

These enzymes are mixed up with inorganic salts, namely, the chloride and carbonates of soda, the phosphates of soda, calcium, and magnesium, to which the alkalinity of the fluids in the duodenum is due.

The three classes of foods, namely, proteids, fats and carbohydrates, are not yet fully digested, and these foods are met in the intestine by an enzyme called secretin or its precursor prosecretin. Secretin is said to be a stimulant to other necessary ferments, and called on that account a *hormone* (*hormao*, I excite). There is, besides these ferments, the succus-entericus (the bowel-juice), which is a lypolytic (fat dissolver) ferment, and also the ferment invertase, which converts any starch left undigested to sugar. There is also met with in the duodenum the enzyme of enzymes, as Pawlow calls it, namely, entero-kinase, which has the property of activating other ferments. In addition to these, there are the actions of the bile, and of micro-organisms, to be considered. Whatever foods have passed the *pylorus* in an undigested state are acted upon in the intestine, and digested there. We have had the starches acted upon by the saliva, and proteids acted upon in the stomach, but there remain still parts of these foods not fully digested. Some of the milk curd also must have escaped from the stomach in an undigested state. Fats are said to be the special *role* of the pancreas and liver. In the duodenum fats become emulsified and saponified, and are split up into acids and glycerine, and so far rendered fit for absorption. No doubt, whatever escapes digestion is acted upon by the numerous ferments mentioned till digestion is completed in the long course of the intestine. Bacterial action, too, takes place, specially on carbohydrates, setting up lactic acid fermentation; all these are also assisted by the actions of organic acids. These acids render the contents of the bowel naturally acid. From proteids, fatty acids and amino-acids are produced. The gases of the intestine are produced especially by the action of bacteria, and the evil-smelling gases skatole, indole and phinol, which if not poisonous are in fair way towards being so. We have all heard of ptomaine poisoning; this is produced by the action of certain bacteria on flesh foods.

There is such a thing known in physiology as extirpation of the pancreas. This produces the well-known disease of diabetes, and it is cured in the animal by transplanting a fresh pancreas in the animal's abdomen. This sort of action has revealed to us the universal truth that each organ of the body not only fulfils its own special duty in the body, but administers to the general well-being of the whole economy, as we learn in general metabolism.

THE LIVER.

The functions of this organ are various, and our knowledge concerning it leaves much to be desired in physiology. It opens up a fertile field for the charlatan and the quack, and everyone claims to have some special knowledge about the liver, as is always the case about anything of which our knowledge is uncertain.

It may be said that bile is secreted here, that glycogen (a kind of sugar) is formed and stored up here for future use ; blood corpuscles are formed in the liver, and again when they have served their purpose in the body, the liver breaks them up and re-uses these or casts them out as refuse. The liver also is said to check thus the admission into the circulation of corpuscles that are injurious to the organism. It is, therefore, a gland that takes its share in the formation of the blood. The great function of the liver is to deal with fats, though we know that the bile itself is an excretion, that is to say, it is secreted from the blood for the purposes of purification. Notwithstanding this, the bile is highly useful in the economy of digestion : it is diastasic, that is, it contains a ferment that changes starch into sugar ; it induces peristaltic action in the intestines, and so prevents constipation. The bile promotes the vital activity of the muscular coat of the bowel in absorbing fats. It is said also to diminish putrefaction in the intestines, and has a mysterious, badly understood influence on the bile salts (organic and inorganic) in promoting the action of the gastric and pancreatic secretions. In the matter of fats the bile helps to form saponifications and emulsions, and so promotes absorption by its moisture and specific influence. Constituents of the bile appear in the dejecta. The bile salts are again re-absorbed in the long course of the bowel, and used again for the benefit of the economy. It should be noted here that the reaction high up in the intestine is acid, though lower in the bowel the reaction is alkaline again, and so is more favourable to the action of the bacteria of putrefaction which are now busy over the further decomposition of the contents of the bowel. When an infant is born the bowel is loaded with bile chiefly, called then meconium. This is a strong point in favour of looking on bile as an excretion. Other intestinal glands, with their ferments and the bacteria of putrefaction, go on with the digestion of the various foods as yet undigested and complete the process.

The various reactions and ferments of digestion are recapitulated here. The reaction in the mouth is alkaline, in the stomach acid, in the duodenum again alkaline, in the part of the bowel next to the duodenum the reaction is again acid, and finally in the lower part of the intestine it is again alkaline. No doubt there are wise provisions in Nature for all these changes, and we may be able to give the reasons for them some day.

The ferments or enzymes mentioned are :—

Ptyalin	In the mouth.
Pepsin	In the stomach.
Rennin	
Pepsinogen	
Hydrochloric acid	
Lipase	In the duodenum.
Amylase	
Trypsin	
Secretin	
Prosecretin	
Succus-entericus	
Invertase	
Entero-kinase	

It may be safely stated that there are numerous others, for example in the glands of the mucous membrane, in the cells of the body, and in the different foods.

Terms Explained.

The writer gives here an explanation of some words occurring in digestion as previously described. *Metabolism* has been used. This term means the chemical changes that occur in the human body. The term is purely a scientific one, and is intimately connected with the food and the destiny of the food in the most minute structures, as for example, the cells. If the structures (cells) require building up we use the word *anabolism*, if they require a breaking up or pulling down *katabolism* is used. When one uses either of these words the mind at once thinks about the cells and the blood, as it is in these that chemical changes chiefly take place.

The writer came across the phrase in Dr. Hutchison's book, "They may be nitrogenous, but this is by no means the same as proteid." The words nitrogenous, albumen, and proteid signify some obscure modifications of the same thing. Proteid means that the substance is of the highest value as a food; perhaps "albumen" comes next to proteid in value, but nitrogenous, though it will have nitrogen amongst its elements, may not have sulphur or phosphorus in its composition, which makes it less valuable as a food. These are not the only words used with the same sort of meaning. It is known that bodies of an albuminous nature are found amongst animal and vegetable structures; we have :—

Legumine,	the albumen	of	the pulses, as peas, beans.
Fibrine,	,,	,,	,, cereal seeds.
Myosine,	,,	,,	muscle.
Globuline,	,,	,,	blood and its corpuscles.
Vitelline,	,,	,,	of the yolk of the egg.
Caseine,	,,	,,	of milk.
Gelatine,	,,	,,	bone and cartilage.
Chondrine	,,	,,	,, ,,

And there are some others.

Now all these, though they are closely allied, cannot all claim in an equal degree to be protein. Protein is chemically regarded as the basis and chief of them all. Protein contains the elements CHNO and sulphur, but not phosphorus. All of them, no doubt, differ somewhat in either the number or in the combination of the number of elements they contain, and thus they are said not to be *proteids*, or to contain protein, though nitrogenous. No doubt some albumens suit one person and some another, but all of them are nutritious, and all of them contain nitrogen.

"Acid and alkaline." These are best regarded as tastes. For instance, the four primitive tastes are acid, salts or saline, bitter, and sweet. The first and last, viz., acid and sweet, are readily understood.

Alkaline is the taste we get in soda or *liquor potassæ*, or bicarbonate of potash. It is the opposite of acid.

Bitter is the taste we get in quinine.

Sweet is well known as the taste of sugar.

It is sometimes said an alkaline has an *acrid* taste; but some training in the use of the tongue in tasting things is required to distinguish these four primitive tastes. The two tastes, acid and alkaline, are those required chiefly in the substances composing the human body, and all foods also have one or other of these tastes as a rule.

Acid and alkaline are chemical terms. When any solution is presented to a chemist he tries its reaction by dipping into the solution a slip of turmeric paper. If the paper is turned red the solution is said to have an acid reaction, and to be an acid ; if the paper is not changed, the solution is said to be an alkaline one.

VI.—INFANTS AND CHILDREN.

(1) *Breast-feeding.*—An infant fed on the mother's breast as a rule goes on pleasantly and easily during its early months. There is no more comforting sight in Nature than to see a healthy infant that is supported by the food natural to it. It goes on feeding and sleeping, and spends the rest of its time in kicking and crowing. If the general public had once the experience of a hard-worked doctor in coming from an artificially reared infant to one fed on its mother's milk, the doctor would be more

strenuously supported in his crusade against the hand-fed baby. It is a lamentable fact now in the twentieth century that mothers so often fail to suckle their own offspring. The contrast between the breast-fed infant and that brought up by hand speaks volumes. The one is a picture of contentment, the other represents, as a rule, a struggle for existence. There is very little doubt this condition is due to the comparatively artificial existence brought about by our boasted civilization. In many cases this inability to suckle the baby is due to a want of development in the mother. To what is this due? One is fairly justified in pointing to the artificial town life of the present day, and the careless and heedless way life is gone through without due regard to its responsibilities.

Generally speaking, the food question should be placed first. To go back to the coarser food of olden times should be the aim of every philanthropist. Plain diet is the first consideration.

Instead of that, our children are pampered with delicacies, and if they do not enjoy the one presented, another is provided, and if the appetite fails, condiments are supplied by the dozen.

The question of feeding and food is of the first importance. That, coupled with a reasonable regard to a life of exercise and fresh air, comprise means that can be urged to make our bodies stronger and more robust than they are at the present day. Of course the question of housing and personal comfort generally have to be urged and studied carefully. One may preach this, that, and the other advantages, but the good will come slowly. Come it will, if the population are trained to habits of virtue, but not without. If the people understand that there are defects, and that there are ways of rectifying them, no doubt the remedies will be used.

The baby on the breast goes on in growth without interruption. It is a joy to the whole household, and as a rule the baby is never heard—it is asleep. The first struggle it has with the outside world is when it has to be weaned. It is now, however, strong enough to face its battle, for it is armed with teeth, and can bear its buffeting. It is an easy and manageable affair to provide a food suitable for its age and powers.

If, however, its mother cannot feed the baby, a wet-nurse is sometimes procured. This is a provision that has advantages and many disadvantages. It is so important a matter that the advice of those able to give it should always be obtained.

If the worst comes to the worst artificial feeding has to be faced. All authorities are agreed that no better substitute can be found than some modification of cow's milk. This subject is not, however, a simple matter, and hitherto many chemists and physiologists have tried it, and it may be said to be as great a puzzle as ever. Hence the number of proprietary foods on the market. It should be recorded here that there is only one food in the wide world that is suitable for the human infant, and that is its own mother's milk. No wonder, then, that an artificial preparation fails. Besides that, the composition of cow's milk is such a complicated affair that it well-nigh baffles the most skilled chemist. When this fact became widely known, scores of foods, each described as "perfect food" for babies, were thrown on the market. Yet not one of these "perfect foods" has been found equal to a modification of cow's milk. A capital article on this subject, viz., "Proprietary Foods," by Dr. Edmund Cautley, appears in "System of Diets, &c." (Oxford University Press), edited by Dr. Sutherland. In that article no less than 155 distinct foods are mentioned. Here is Dr. Cautley's final summary: "The greater knowledge possessed by the individual of the composition of natural and proprietary foods, and of the various means of modification by simple home methods, the less will he find it necessary to have recourse to the manufactured article, and the better will be the result of his dietetic treatment." "Although unnecessary, it must nevertheless be clearly realized that such foods are sometimes of the greatest value." "It is equally important to realize that a knowledge of the composition is essential to the proper use of any proprietary food." The general impression on this subject amongst medical men is that such foods should be used with care and caution. No doubt there are excellent foods amongst them, but the price is prohibitive to the general public, and, moreover, in nine cases out of ten highly unnecessary.

To return to the feeding of babies on cow's milk. Of all the problems before medical men, physiologists, and scientists, there is none more important than the modification necessary in cow's milk to make it suitable for the rearing of infants. Many have tried it hitherto, and all that can be claimed for any modification is that it is fairly good—only fairly, be it observed, as no modification is

	Human milk	Cow's milk	Whey
Specific gravity ...	10·32 per cent.	10·28-34 per cent.	Same
Proteid	1·62 ,,	2-3 ,,	0·82 per cent.
Fat...	3·14 ,, (poor in volatile glycides)	3·5-4·5 ,, (rich in volatile glycides)	0·24 ,,
Sugar	6·26 per cent.	4-5 per cent.	4·65 ,,
Citric acid	0·05 ,,	2 or 3 lemons in one cow's milk	As citrate of calcium
Extractives (unknown)	0·91 ,,	—	—
Reaction	Alkaline	Acid	—
Minerals	0·27 per cent.	0·7 per cent.	0·65 per cent.
Water	87·75 ,,	87-88 ,, (same)	93·64 ,,
Total solids ...	12-13 ,,	13-14 per cent.	—
(1) Caseinogen ...	⅓-½ of proteins	2·66 ,,	—
(2) Whey proteins	⅔-½ ,,	0·84 ,,	—
Coagulation of proteids by rennet	Not readily; curds small	Readily; curds large	—
Coagulation of proteids by acids and salts	With great difficulty; curds flocculent	With less difficulty; curds large	—
Gastric juice ...	Proteids precipitated but easily dissolved	Dissolved less readily	—

possible to make the artificial article equal to the natural one.

We have mentioned already the legion of "perfect foods" on the market, not one of which can equal the only one food suitable.

It is well known that the infant mortality is very high (as high as 80 per 1000: Dr. Boobbyer of Nottingham); whereas the mortality for adults is as low as from 10 to 20 per 1,000. It is an accepted fact that hand feeding of infants is a fertile cause of early death. Every effort should therefore be made to get mothers to suckle their own babies, but over and above the necessity of getting mothers to undertake this paramount duty, there exists sheer inability amongst mothers in England at any rate to face or bear the duty. What are we to do to lessen that? This arises, as above stated, from a misuse of food, for undoubtedly a plainer kind of diet leads to a stronger and more robust race. In this connexion one hails with joy the new proposal by leading medical men in London. That is to make the wholemeal loaf a legal bread that the poor can have supplied to them without any doubt as to its nature.

VI. (*continued*).—INFANTS AND MILK.

Every care and consideration should be given in preparing cow's milk for the infant. Amongst the poor this is very difficult, but if any one tries it, the following points should be carefully considered one by one :—

1. *The Proteins.*—This is of all ingredients the one most difficult to deal with. It is not only of greater amount in cow's milk ; it is different, and presents more difficulties than any other ingredient of the milk.

2. *The Fat.*—This is rather more in human milk and the globules are smaller.

3. *The Carbo-hydrates* (sugar) are more in human milk (see table).

4. *The Sterility or cleanliness.*—Tubercle, fevers, etc.

5. *The coarse filth* in cow's milk should be guarded against.

6. *The reaction* is different in each, though not so important as No. 1 for example.

7. *Minerals.*—These are more abundant in cow's than human milk and also different in structure. Compare the milk tables.

VI. (*continued*).—INFANTS.

MODIFICATION OF COW'S MILK.

There are ten modifications mentioned in Standard Books on this subject, all of them referred to here, but only the best of them described in detail. The tables of ingredients of human and cow's milks should be constantly before one, so that a reference for comparison can always be made; of all the ingredients of cow's milk none has given so much concern to medical men and physiologists as the proteid of milk or casein. This is the substance (though well understood in the dairy) that has caused, so far, the stumbling-block to doctors and physiologists in attempts to suit the infantile digestion with artificial food.

The first modification of cow's milk is simple dilution. Simple dilution will very soon be found inadequate for the purpose of feeding the baby. All mothers should be very particular in following out the dilution plan and its modifications first, before any other of the myriad plans is adopted.

For the first fortnight cow's milk should be diluted with *three* times as much of fresh pure water; after that period till the infant is 3 months old, with *twice* as much water; after that till the age of 6 months with equal parts; from 6 to 9 months the proportion should be two parts of milk to one of water. The diluents should be either plain water, barley water or lime water. Either lime or barley water is equally efficient; they prevent too dense a clot of the casein forming in the infant's stomach. The barley water should be most carefully made twice a day, as it keeps badly. This is the direction given by Dr. Sutherland in "A System of Diet and Dietetics." "Take a tablespoonful of pearl barley, wash it, put it in a pint of water and bring it to the boil, then let simmer for half an hour: strain and use as required." Lime water can be bought at the chemist's for a trifle if not made at home. That is not enough. In diluting the milk we have reduced the fat and the sugar too much. In both of these breast milk is very rich. It is only the proteid or cheesy part we have made of the proper proportions in diluting. The tendency is to give baby too rich a food; therefore begin for the first week with simple dilution; after that the addition of fat is advisable. The mother has three or four articles that she can select from—cream, butter, margarine and cod liver oil; these are all good for the purpose. The cream that comes naturally to the top of a milk vessel is called *gravity cream.* It contains about 20 per cent. of fat. Holt's plan is as follows:—He gets a pint of fresh milk from a *mixed* herd and puts it aside for four hours. In that time the top 4 oz. will contain 20 per cent. of gravity cream. Separated cream contains about 40 per cent. of fat; margarine and butter contain about 82 per cent. of fat. Proceed as follows:—

Take	7	oz. of	milk.
	7	,,	lime water.
	7	,,	ordinary water.
	1	,,	gravity cream.

22 oz. of food containing about 4½ per cent. of gravity cream, which is about the proportion in breast milk. It should be remembered that the ounce of cream contains the proteids, carbohydrates and ash of the milk, but for such a small quantity as an ounce they may be disregarded.

We have seen that gravity cream holds half as much fat as separated cream, and, a quarter as much as butter and margarine. If therefore we use separated cream we should only require half an ounce, and in proportion less of the butter and margarine.

The dilution also throws out the proportion of sugar in our milk from 4·50 to 1·50 per cent. For this deficiency we can make use of any of these:—Sugar of milk, cane sugar, extract of malt or honey. Sugar of milk is the best, but is too expensive for ordinary use. Maltose can be bought in the form of extract of malt, which contains about 50 per cent. of maltose (sugar) and is an excellent form to get its sweetening effect, and in addition the extract contains 5 per cent. of proteids, 15 to 10 per cent. of starch, 1 to 2 per cent. of ash, in addition to a valuable digestive ferment, and it is admirably suited for babies. Honey contains 74 to 78 per cent. of a predigested form of sugar (Hutchison) and suits infants well. The amount added will vary with the age of the child, but during the first month should be ½ oz. each of sugar of milk, honey or the extract of malt and 3 dr. of cane sugar to each 15 oz. of the food. Let the milk be boiled in a pan placed inside another containing water

TABLES OF THE AMOUNTS OF BREAST MILK.

Amount of Breast Milk (Sutherland).

Secreted in the first week daily	10 to 16 oz.	or up to $\frac{3}{4}$ pint.
,, ,, second ,, ,, ...	13 ,, 18 ,,	,, 1 ,,
,, ,, third ,, ,, ...	14 ,, 24 ,,	,, $1\frac{1}{5}$,,
,, ,, fourth ,, ,, ...	16 ,, 26 ,,	,, $1\frac{1}{2}$,,
,, ,, fifth to thirteenth weeks daily	20 ,, 34 ,,	,, $1\frac{3}{4}$,,
,, ,, four to six months	24 ,, 38 ,,	,, 2 ,,
,, ,, six to nine ,, ...	30 ,, 40 ,,	,, 2 ,,

(Hutchison, quoting Freer).

Amount required daily, first week	291 grm.	up to $\frac{1}{2}$ pint.
second ,, ...	549 ,,	,, 1 ,,
third ,, ...	590 ,,	,, 1 ,,
fourth ,, ...	650 ,,	,, $1\frac{1}{5}$,,
fifth to eighth week	687 to 804 ,,	,, $1\frac{1}{4}$,,
ninth to twelfth ,, ...	815 ,, 828 ,,	,, $1\frac{1}{2}$,,
fourth month...	852 ,, 893 ,,	,, $1\frac{1}{2}$,,
fifth ,, ...	902 ,, 947 ,,	,, $1\frac{3}{4}$,,
sixth ,, ...	956 ,, 980 ,,	,, $1\frac{3}{4}$,,

1 oz. is equal to
30 grammes.

(or in a double-cooker), the boiling to be continued for five minutes. Thereafter the food should be put in a clean glass vessel covered with cloth or cotton wool and kept in a cool place. The greatest care should be taken in all these procedures against fresh contamination, as it may be said that the milk comes from the boiling process in a fresh and pure condition.

It should be remembered that the above quantities are general averages for healthy babies, which must therefore be varied for the health of the baby in question, as necessary. One thing should never be forgotten, and that is the amount of milk supplied by nature at the different ages of the infant. On p. 60 is a table that one should always have at hand.

Hutchison and Freer give practically the same amounts, using the metric measures; perhaps they are inclined to give rather less, but as the tendency is to overfeed, it is well to have the amounts supplied by nature before one which Dr. Sutherland gives. It is important to remember that breast milk is liable to many variations, and every circumstance should be particularly enquired into, such as the food of the mother and the drink likewise. Fair and reasonable restrictions are necessary, and with these the feeding of the baby will go on without interruption as a rule. In feeding artificially with cow's milk the following other modifications are sometimes adopted:—

Mixed Feeding.

This may happen from many causes. The main point (and that is very important) is that mixed feeding (that is, partly breast milk and partly artificial food) is worthy of all trial. It is much better for the successful rearing of the infant than to put reliance on the food being all artificial. The idea that a part of each kind of food militates against the method of mixed feeding should not be countenanced. Every effort should be made to retain the use of a part only of the breast milk. It is so valuable for the infant that nothing, short of inability to continue it, should make the mother give it up. She should be told, or reminded, that there is only one food quite suitable for baby. Peptonized milk or the whey food are good substitutes for the artificial part of the mixed feeding during the first month. After that the dilution of cow's milk as detailed previously should first be adopted. When one remembers the precarious hold on life that the artificially-fed baby has, it is enough to impress one with the importance of the mother's milk, even if in part only. No pains should be spared to make mixed feeding a possible and proper method.

Other Modifications of Cow's Milk.

Sterilization.—An apparatus is necessary for this, either Soxhlet's, Arnold's, or Cathcart's. It means the exposure of the milk to a temperature of 212° F. for a period of half an hour to an hour and a half, according to the amount of sterilization required—that is to say, some babies require more sterilization than others to aid their digestion. The milk if sterilized will require the modifications of dilution, of fat, and of sugar, mentioned previously. It is said:—

(1) That infants fed on sterilized milk show evidences of rickets, scurvy, or anæmia. This method on the whole is not a favourite one with doctors. It may be adopted in cases of ill-health, but generally speaking it is

not to be recommended. Sterilized milk is supplied from dairy companies here and there.

(2) *Pasteurization.*—This process also requires a special apparatus. It is exposing the milk to a temperature of 158° F. for half an hour or longer. It is said that the diseases mentioned under sterilization are avoided by the lower temperature here employed. The carrying out of this process requires more skill and time than can be usually given.

(3) *Laboratory Milk.*—This is an American method, and theoretically it ought to answer well. In practice the method is too complicated, and passes through too many hands ever to make it a success. Possibly, if carried out properly, laboratory milk would be found quite suitable; but what people want is simple home modifications that can be easily adopted. It is an example of scientific treatment, and that is worthy of admiration; but, surely, it is impracticable to have so many complications in feeding babies.

(4) *Municipal Milk.*—This is a supply of milk suitable for infants undertaken by several municipal authorities. The plan has been

modelled on the system adopted in France, pioneered there by Professor Budin. It is a most praiseworthy attempt to lessen the mortality of infant life during the first year. The supply is under the skilful direction of the Medical Officer of Health, and every precaution is attended to, to make the work a success.

(5) Budin's method (without dilution or addition). This is a most wonderful method. The advantages, according to the author, if at all true, are contrary to the experience of experts in this country. They are these: "No tumid abdomens, no dyspepsias, no rickets, no scurvy, no tubercle, no eczema, no weakness." The milk is sterilized. He further says that if failure takes place, it is because too much food is given to the infant. The sterilization must have much to do with the success of the method, which has the support of distinguished men in this country. Cow's milk has hitherto been found too strong for rearing infants on, but Budin's method is worthy of all trial, inasmuch as the difficulties of dealing with cow's milk have been well-nigh insurmountable.

(6) *Top Milk.*—This is a favourite method with many physicians. They try to make this plan simple, and they give very precise directions, but it requires careful thought and careful observation of the rules. The quality of the milk is in no way interfered with, and it is by all accounts a reliable method if properly managed. Here are two directions by experienced doctors :—

Dr. Ashby.—Put down 30 oz. of milk in a glass bottle for four or five hours. The top 10 oz. will contain 10 per cent. of fat ; the top 15 oz. will contain 7½ per cent. of fat. Remove the lower part and replace with water —that is, the lower 15 or 20 oz. ; dissolve 1 oz. of sugar of milk in 1 oz. of water and add that ; pasteurize and cool. The weaker will then consist of :—

Protein	1 to 1·3	per cent.
Fat	3 ,, 3·5	,,
Sugar of milk ...	6	,,

The stronger will consist of :—

Protein	1·75	per cent.
Fat	3·35	,,
Sugar	6·0	,,

Infants of 3 weeks should be able to take top milk containing 10 per cent. fat, diluted with two parts sugar water (that is diluted with two parts water, and sweetened); and at the age of 3 or 4 months, top milk, cream 7 per cent., water equal parts and sweetened. That is for an average infant.

Dr. Cautley.—Put down fresh milk for three hours. Top half is then separated; this contains about 8 per cent. of fat and usual per cents. of protein and sugar. For an infant under 3 months, take 5 oz. of this top milk, add 1 oz. of lime water, 6½ drachms of sugar, 14 oz. of water; it will very nearly then be: protein 1 per cent., fat 2 per cent., sugar 5 per cent. If well borne, add 1 oz. of milk, and take away 1 oz. of water every week until you get the food of the infant to consist of milk 10 oz., lime water 1 oz., water 9 oz. If more fat is thought desirable, all that is necessary is to use more of the top milk, and so on; the mixture can be varied with sufficient accuracy provided the milk bought is reliable, and of good average quality.

(7) *Whey.*—This is a favourite method of feeding infants with some people, both doctors and the lay public. The directions are as follows:—Heat half a pint of fresh whole milk to

104° F., add a drachm of liquid rennet. Stir the mixture, and allow to stand till the curd forms. Break up the curd and strain through a piece of muslin. The whey should then be brought to the boil to stop the action of the rennet. Dr. Still then uses the whey as follows :—

Milk	6 dr.
Whey	18 ,,
Gravity cream...	1 ,,
Milk sugar ...	½ level teaspoon.

Resulting composition.

Casein	... 0·81	per cent.
Lactose albumen	... 0·75	,,
Fat	... 3·87	,,
Sugar	... 6·50	,,

This is looked upon as being very near to breast milk in composition. Whey is such an important diluent for the purpose that the method should be well known to every mother. See back for the composition of whey, cow, and human milk, p. 53.

(8) *Citrated Milk.*—Attention was called in 1893 by Wright to the importance of lime salts in cow's milk in producing a dense curd. The ingredient in human milk corresponding to lime is potash. Citric acid is a constituent both of cow's and human milks. Wright found

that the addition of citrate of soda precipitated the lime in milk, and prevented the formation of curd in the stomach. The chemical changes are explained by Poynton, and are rather complicated.

Poynton uses one grain of citrate of soda to each ounce of milk used, and the result is that the clot formed in the stomach is much softer and finer, and more easily digested. Tabloids can be bought of 1 grain each of citrate of soda, and when several ounces of milk are ordered at a time, a few drops of chloroform should be added to prevent any mould forming. Citrate of soda is harmless to the infant, and the amount required can be judged by the amount of curd passed in the stools. This method is to be recommended as worthy of trial. Notice that no dilution of the milk is needed, which is an additional advantage in favour of citrated milk.

(9) *Predigested Milk.*—This is an additional method in order to make a difficulty easy to the baby stomach. Fairchild's powders contain all the ingredients necessary for predigesting milk, with full instructions. Several objections are raised against the method, but it is one

that may well be required in weakly infants and in cases of disease; but it is not a plan that can be recommended for healthy infants.

(10) *Addition of Cereals.*—This is not a method that can be advocated by a medical man, as it is not in accordance with nature's plan.

VII.—AFTER WEANING, NINE TO TWELVE MONTHS.

By the time baby is nine months, it will have learned to battle successfully with its food, whether on the breast or reared by hand. In the case of the breast baby there is a great struggle to give up its natural food and take to cow's milk. The artificially reared baby, by the time it gets to nine months, should have learned to take ordinary milk undiluted, so that its course is pretty well plain sailing. Carbohydrates can now be added, but let it be clearly understood that milk is by no means to be discarded. It is as a supplement that any addition of cereals to the food can be used. The common tendency is to advance too quickly, and to forget that milk is still the natural food. One is strongly in favour of oatmeal porridge, properly made and properly boiled, and of a quality suited to the age of the infant, as a proper addition to the baby food. There are also good proprietary foods, *e.g.* Mellin's, Savory and Moore's, and Benger's, which may be used with advantage. Here is Dr. Eustace Smith's method of preparing wheat-flour :—

Flour is cooked in the dry state in an earthenware jar in a slow oven, from time to time stirred up to prevent lumps. Of that flour a teaspoonful is mixed thoroughly with baby's food (the milk) and given in the ordinary way. It of course is properly sweetened and carefully made.

Barley is prepared as follows :—A tablespoonful of ground barley is mixed well in a pint of cold water and boiled down to half a pint. A dessert spoonful, or more if desirable, is added to 6 oz. of milk for a meal : it should be sweetened with extract of malt.

The baby should take at this age from one and a half to two pints of undiluted milk a day, and about five meals in every twenty-four hours ought to suffice. Orange or grape juice may be given daily as an anti-scorbutic. Dr. Sim

Wallace's advice is that the teeth should be properly attended to at this age by giving hardish substances to bite at and chew, for instance, a hard crust or fruit.

Infants in second year.—The same principles should be observed here: the food may be stronger generally. These additions may be given—pounded meat or fish, gravies, bread and butter, puddings, eggs, bacon, potatoes, fruit jam or honey. We have all heard of spoilt babies. Nothing is easier than to drift into carelessness about the food. It should never be forgotten that the plainer the food the healthier is the child. Infants can easily make inroads into a parent's safeguards against the use of sweets and tempting foods, and they very soon find that out. Duty is one thing that should never be neglected, for the day of reckoning is certain to come, and it follows as "the night the day" that plain living makes the healthier race. With that precaution the writer would not be afraid to trust the rearing of children after the first year to the merest tyro in food. Moreover, habit is a thing worthy of all remembrance, for what the infant is trained to eat and drink, that is the food above all others that is liked and enjoyed in after years. This does not mean that good food *per se* is to be avoided. It should be emphasised, in season and out of season—the importance to the individual of plain living; and especially knowing well that the habit the digestion forms early is the habit which is valuable in after years. "Habit is to us a kind of second nature": one would think that this saying is repeated *ad nauseam*. It is when the individual is old that he finds out how precious habit of a useful character is. As the famous Sir William Gower says: "You have three lessons to learn, the first is recapitulate, the second is recapitulate, the third is recapitulate."

VIII. VEGETABLES.

(1) Vegetables Generally.

This is the great source of starch and starchy foods, or, as we say in scientific language, carbo-hydrates. This class is in contrast to proteids and fat, which are chiefly derived from animals, though by no means exclusively. In the vegetable kingdom, moreover, there are better examples of the four essential forms of food, namely proteids, fats, starches and minerals, than in the animal world. If one were limited to one kingdom for the supply of these essentials, it would be safer to rely on vegetables as the choice of kingdom. This will be clearer as we go on. Starch is familiar to us as we see it in the laundry. In vegetables (and in the human body) it is held in compartments by a framework, called in vegetables cellulose, and in animals connective tissue. When starch circulates in a plant it takes the form of sugar, to which it is readily convertible. At a high temperature starch takes the form of dextrin, which we see as in the crust of bread: this is also in the form of sugar, familiar to one as the adhesive on a postage stamp. Cellulose is a common structure in all plants and therefore frequent amongst our vegetable foods, and interferes with, or obstructs the action of the gastric juice, as for instance in wholemeal bread. Here the *cellulose* serves a most important purpose in promoting the peristaltic action of the bowel: it also requires the more thorough mastication of the food in order to get, as we say, "the goodness out of it." These two purposes are the very foundation of our life and welfare, and should be attended to first and foremost in all foods. If any kind of food promotes these two actions thoroughly, that is the food that is valuable to man. Herein the chief value lies of wholemeal bread, for example, and not particularly in its superiority as a food over the finer kinds of bread.

Cellulose is not a food: it is of a fibrous nature, and too tough for the digestive organs.

There is some of it amongst most of our foods and particularly amongst our coarser foods. It is a most useful substance, though disliked by many, but in avoiding it, such as not eating coarse bread, people deprive themselves of a most necessary substance for the natural, regular action of the bowels. Besides doing that, cellulose is nearly always in combination with the minerals so necessary for our health. We see examples of cellulose in vegetables of all kinds, in fruit, in all cereals, and many eat the coarser cereals entirely for the benefit they bring to health. In old plants cellulose acquires more toughness and firmness and forms wood. In the young plant it is soft and succulent: it then forms a framework easily penetrated by the digestive juices, such as ptyalin, pepsin and other ferments.

Another group of starchy bodies is met in vegetables, called pectin bodies, which give to fruits the power of forming jellies. The proteins in vegetables are called globulin, but the protein bodies known as *Nucleo-proteids* are less met with in vegetables than in animal tissues. All proteids are coagulable by heat, and so rendered more difficult of digestion. This is contrary to our general impression respecting cooking; hence we give raw meat in diseases, it being accepted that raw meat is more easy of digestion than cooked meat. Starch on the contrary is aided by heat for digestion, for the heat bursts the starch cells, and thereby makes way for the action of the digestive juices.

Fats in the oily state are frequently met with in vegetables, so are the substances called extractives, though animals are the great source of extractives. The remaining ingredients in vegetables are the salts or minerals: an excellent table will be given from Lieutenant A. E. Powell's book on food with the salts in vegetables generally. Water is the chief ingredient in all vegetables, as will be seen in the tables of analysis. Masson's patent was obtained for the purpose of presenting vegetables in the dry state without the water.

VEGETARIANISM VERSUS A MIXED DIET.

This is a question bound to interest anyone who gives any thought to foods. All writers are agreed that people eat too much animal food. Chittenden in his experiments reduced the proteids in the diet from 120 grm. (Voit's Standard) to $\frac{1}{2}$ (one half) or one third of that amount without any detriment to health or vigour, as far as he was able to tell by every known test that he could command. The writer hereby supports Chittenden through and through with all the knowledge of foods acquired in a fairly long lifetime, and through his training in the healing art. The writer himself was brought up as a boy and youth in a part of Scotland where, by the circumstances of the country, it was the rule to limit the amount of flesh consumed to the lowest possible allowance: he never knew anybody suffer any drawbacks whatever in the matter of food. The question of vegetarianism never arose then. The greatest amount of the food consisted of carbo-hydrates, and there was no need of thinking of a flesh diet. Milk, cheese, butter and fish were always to be had. It is true that people valued flesh above all other foods, but natural instinct and the circumstances of the country saved them from any charge of ignorance. What ignorance? Ignorance in the cultivation and use of vegetables. Two Scotch dishes came mightily to the assistance of the people in this safety, namely "porridge with milk" and "Scotch broth." It is a pleasure to bear this testimony to the fact that these two dishes are well known to-day all the world over. In far-away New Zealand, in Australia, and in Canada, they are as well known as in Scotland. Everyone should know how to make porridge, and everyone should know the story of Queen Victoria and the Aberdeen "wifie" "with everything 'intilt,'" as an Englishman once described the delicious "Scotch broth" he had at a shooting lunch in this county.[1] (See p. 79.)

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[1] The Rev. J. C. Grant, M.A., of Nottingham, writes:

"SCOTCH BROTH.

"There is a story that the good old Queen (Victoria) in her quieter visits about her own door at Crathie

"Eating too much flesh!" This is one of the curses of the English-speaking race to-day. To believe anything else than having a full supply of flesh in the diet is looked upon as a vegetarian fallacy. Vegetarian doctrine is the source of my belief, though vegetarianism is somewhat of a fallacy itself. That doctrine is impossible in face of all nature to the contrary; though it must be acknowledged with gratitude, the amount of most useful information and moderation in diet, and especially moderation in the use of flesh the population of the world owes to that doctrine. Vegetarians

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(Balmoral) came one morning on an (old) wifie making Scotch (what other could she?) broth, and asked for a recipe, which the wifie gave her right away. 'First o' a' Yer Majestie, I pits on the pottie wi' watter intil't, syne I pits the barley intil't, and syne—' 'But what's intil't?' asked the Queen. 'Weel, that's jist what I'm telling Yer Majestie. I pits the barley intil't, and the pease. Then when I hae minched the vegetables, cabbages and onions and carrots and sic' like, I pits them intil't.' 'Yes, but please tell me what's intil't, for I don't understand?' 'Losh, yer Majestie, is na that jist fat I'm tellin' ye? I pits the cabbage intil't, and the leeks intil't, and the neaps intil't, and. . . . .' 'But can't you tell me what's intil't?' 'I'm sure, Yer Majestie, that's jist fat I'm tryin' tae dae.' And I do not know that either ever penetrated further."

have drawn attention to the fact that it is possible to support life well on foods exclusively of vegetable origin, and that the four kinds of nutriments essential to life can be obtained from the vegetable kingdom. The vegetarians have overlooked the fact that all animals, as far as known, take animal food as a first beginning. That is a fact in nature. There may be rare exceptions, but they are practically unknown. All mammals begin on milk: the calf even, the foal, the lamb, which are quoted as good examples of life supported on vegetables only, begin life by imbibing animal nutrition. Sir Henry Thompson, the author of that excellent book on "Foods and Feeding," draws attention to this fact—namely, that all animals begin life on animal food, and he also mentions that most vegetarians use milk, butter, cheese and eggs, and suggests the application of the term "flesh abstainer" to such vegetarians. It is no hardship to support life if one is allowed milk, cream, butter, cheese and eggs, and to call such an one vegetarian is surely a misnomer. Chittenden in his experiments allowed his men to eat what they liked best; he was only particular in one thing

—the amount was limited by the rules laid down. There is true wisdom in this plan, and it has here loyal adherence. "Eating too much flesh food!" There never was a more unpopular doctrine. The doctor who overfeeds his patients is the man who is hailed with joy. The people like the plan. Man rarely likes to be limited in his food or drink. Anyone who preaches moderation is soon given the "go-by." So much do men and women love unlimited supplies of food and drink that the man who advocates abstinence in food and drink is as a rule avoided. One would think the medical man who says a word about quantity has a personal object in view.

Man is an animal. This one often forgets. He is subject to the same tendency about foods as animals are.

One of man's dangers is the great advancement in the culinary art. When one has quite a number of most appetizing and tempting dishes placed before him it is little wonder if he gives way to his purely animal nature. It is no wonder either that men and women find it necessary to pay visits every year to a foreign spa, and undergo "treatments" to get rid of all the poison accumulated in their poor bodies since last year! One way of avoiding the temptation of "banquets" is to limit one's daily diet to one or two dishes, and these should be of the simplest and plainest kind. We are slaves to fashion, but surely health comes before fashion. Wise men everywhere avoid carefully the poison of overfeeding. These are easily known in comparison to the glutton and wine-bibber, who prefers to show by his corporation and high stomach that he enjoys the good things of the table. Such a man may have the plain truth told him, that he must either live as it were "on 6d. a day and earn it," or else bring on one of the diseases in Dr. Pavy's list (p. 9). "Life is sweet," and as a rule man will "pull up" when one or other alternative is placed before him. Frequently, it is sad to relate, all wise advices are disregarded, as they have been for centuries before now.

One point has so far been omitted: the disadvantage too much food is to the strength which the body has left over for other things. The office of digestion and all allied actions require strength as much as any other actions of the body. For instance, walking, talking, thinking, reading, working with spade or saw and so on require energy and wasting of the strength of the body. When all the powers of the body are exhausted it requires restoration. So it is a fact that eating and digestion use up a certain amount of energy. Certain tribes indulge inordinately when given freely of animal food till at last they fall off to sleep, and take a day or two to recover. Amongst civilized people it is not unknown to see something of the same kind. The point of interest to the physiologist is that beyond a certain amount of food there comes a point which it is no advantage to pass.

Many men seem to live for the purpose of eating: very few have the belief that the purpose of eating is to live. Of course there are numerous examples of sensible men and women who are ruled at table by reason and common sense, but they are the exception.

It is right and necessary that the use of animal food for the young and growing should be admitted. The universal impression that we make use of too much food, especially animal food, is undoubtedly true. Sir Henry Campbell-Bannerman's statement (approvingly quoted by many leaders of thought since Sir Henry's days) has already been mentioned, viz., that there are 12,000,000 in this land of ours underfed. (See page 5). We must feed our people, that is imperative. No question about too much food amongst these 12,000,000. To them it must be nonsense to speak of vegetarianism. Amongst the well-to-do and in adults less animal food must tend to better health and better strength, less illness, less disease, and very much less need of the medical man. When is man to begin lessening his animal diet? No one can tell: each man and woman must be a law unto him or herself. The amount of work that a person has to do must influence the amount of his food. The idle and sedentary, it goes without saying, require very much less sustenance. Labourers and men of toil require very much more, and men who are generally out in the open consume a more liberal diet, and moreover it suits them to follow a vegetable diet more than those confined to houses and in the close air of towns.

It will be noticed that on this page an attempt is made to give directions for the amounts of food one should eat. Where good sense is the guide in this no rules are necessary. Generally speaking, the young should have a reasonable amount of flesh in their diet, and so it should be continued through the years of youth and early adult life. This is admitting that age has much to do with the question of the use of flesh or no flesh. It has passed into a proverb "Bread is the staff of life." No one ever thinks "bread" here refers to flesh. It is clearly on the side of the vegetarians. Chittenden in his experiments purposely lessened the flesh proteid and the men flourished without it. As far as the writer knows, he was right. When men understand that flesh is more of a stimulant than a food, the sure tendency of our race will be towards a vegetarian food. As man advances in years and gets, as we say, "set" he requires little or no flesh. His health is thereby better, as many can testify from experience. The question is largely one of temperance. The inclination to stimulation is strong in the human race. Flesh is a stimulant, alcohol is a stimulant. Hitherto the use of flesh has been admissible in the food of the people. There is little doubt that stimulation through eating flesh has led to the injury of the health of the race. This will be called nonsense, or an extreme view, by many. The writer deliberately thinks it is sober truth. It is true that the use of flesh food has increased enormously lately. This may have been contemporaneously with the increase of riches. It may have been only for about the age of a man, but the injury to the health of the nation is now beginning to be known, and there is a reaction. At any rate, the writer thinks the use of flesh should be very much less than it has been in the reign of Queen Victoria. This means that there should be less and less flesh in the diet as one advances in years. If people only try it, health is very much improved and bodily comfort increased. This is a fact many can testify ; and the writer can bear witness to the delightful old people he met in his life who of themselves lessened the amount they took in the day, and he thinks thereby added to their comfort for years and, moreover, added many years to the duration of their life.

(2) *Cereals.*—Cereals contain abundant examples of the four kinds of nutrients essential to man. The amounts of proteids vary in all

cereals but "probably all grains are equally nutritious." (Dr. Hutchison). Fat is more abundant in the grains of northern latitudes, *e.g.*, oats. Wheat is easily the most important cereal in the world, and the question of the wheat of the world is every year of great influence. Bread made of wheat is universally the leading bread of the well-to-do everywhere. Other grains have local advantages in many lands and are popular in the localities where they grow, as we shall see.

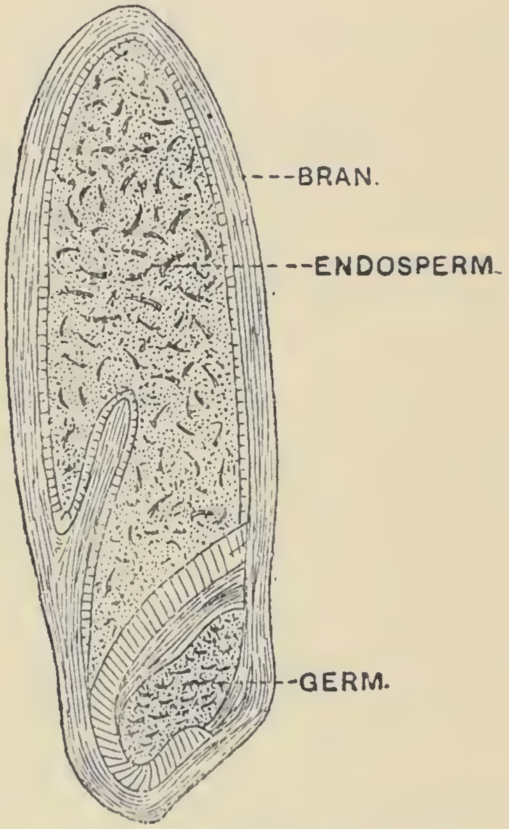
Here is a table of analysis of the different grains made into meals :—

TABLE OF ANALYSIS OF CEREALS.

	Water	Proteids	Fat	Carbohydrates	Cellulose	Minerals
Wheat meal	12·1	12·9	1·9	70·3	1·6	1·2
,, fine flour	13·0	9·5	0·8	75·3	0·7	0·7
Oatmeal ...	7·2	14·2	7·3	65·9	3·5	1·9
Rolled oats ..	7·2	15·4	7·2	64·8	3·5	1·9
Barley meal...	11·9	10·0	2·2	71·5	1·8	2·6
Pearl barley	12·7	7·4	1·2	76·7	0·8	1·2
Rye flour ...	11·4	15·3	2·1	66·7	2·3	2·2
Finest ditto...	11·2	6·7	0·9	80·0	0·8	0·4
Maize meal...	11·4	8·5	4·6	72·8	1·8	1·3
Fine maize meal	12·5	6·8	1·3	78·0	0·8	0·6
Buck wheat flour	14·0	7·1	1·2	75·9	0·6	1·2
Millet flour...	12·4	6·4	3·9	68·3	2·9	2·2
Rice(polished)	12·0	7·9	2·0	79·2	0·4	0·4

Sago and allies are given under Roots and Tubers.

This analysis is only approximately correct, being an average of a great many analyses



A grain of wheat split in two (Hutchison).

(Illustration from "Food and Dietetics," by permission of Mr. Edward Arnold.)

(Hutchison). It will be noticed that carbohydrates are abundant in all cereals ; this is no doubt the reason that breads are never eaten as a rule, alone, but in combination with other foods rich in other ingredients necessary to support life, as butter, other fats, milk, cheese, and meats. All cereals are extremely well absorbed. They are placed in the front rank of all foods. It has passed into a proverb that "bread is the staff of life."

(3) *Wheat.*—It is said that we use 6 bushels per head every year. When we remember that other cereals are largely used in the British Isles this is a high average. The parts of a grain of wheat are: the bran, the endosperm, and the germ. All these have shares in the essential ingredients of food. The parts are all rich in carbo-hydrates: the bran is richest in salts and minerals and cellulose, as one would expect. The germ is the smallest, but the richest in proteids and fat; the fat is of an oily nature, apt to become rancid and spoil the rest of the flour. The miller, therefore, gets rid of this substance altogether, which is comparatively easy to do, as the oil makes the germ tougher and disposed to adhere together. By Smith's patent one part of germ flour is mixed with three parts of ordinary flour and constitutes Hovis and other germ breads. This flour, therefore, is rich in

proteids and fat in proportion to the amount of germ flour mixed in it.

The bran supplies four kinds of meal, namely, bran, pollards, sharps and middlings; the bran, or part thereof, is what is patented as Frame Food.

The endosperm supplies: Firstly, Patents or Whites, and secondly, Households. Households is further sub-divided into Second Patents, First Households and Second Households.

A blend of different wheats is frequently used according to the moisture and gluten they contain.

Table of the different flours spoken of:—

	Wheat-meal	Medium flour households	Finest flour	Hovis	Frame food extract
Water ...	12·1	12·3	13·8	12·2	9·8
Nitrogenous matter	14·2	10·7	7·9	15·5	16·5
Fat	1·9	1·1	1·4	3·2	1·0
Carbo-hydrates and cellulose	70·6	75·4	76·4	70·0	63·0
Ash	1·2	0·5	0·5	2·3	8·8
	100·0	100·0	100·0	103·2(?)	99·1

Bread.—When bread is spoken of it is almost always the bread made of wheat that is meant. The quality in wheat that specially fits it for leavened bread is the "gluten." Rye meal comes nearest flour in having "gluten" in its composition. The other cereals have no gluten, and bread made from them has to be unleavened, *e.g.*, the oatcake of Scotland. Gluten is a proteid, and besides possesses the quality of adhering together when once it is distended with gas. This is the chief object in bread-making, namely, to distend the bread with gas. How to devise a plan for this purpose must have taken ages to discover. At length it was found that *fermentation* would do it. The yeast plant is the ferment that is most frequently employed in bread-making. What is a ferment? A ferment is a material of no use in itself for the purposes of food, but it induces a chemical action in flour by means of its effect on the starch in the flour. Starch is readily, in the presence of water and warmth, changed into sugar, and yeast has the power of creating a chemical change in sugar converting it into alcohol and carbonic acid gas. All the alcohol is ultimately lost by the heat of the oven and so is all the gas, but the gas first creates a fermentation (*fervio*, I boil) in the dough, distends it, and then by virtue of the gluten in the flour the bread remains distended. That is the foundation of fermented bread. There is more than one way of baking, as there is more than one way of creating the gas in question, *e.g.*, baking powders, aerated bread (Dr. Dauglish's process) and the Scotch fashion of using balm and malt. The science of baking and bread-making are carried to a high efficiency, and so is the *milling* of wheat; and this is not to be wondered at seeing that wheat so far forms the chief bread of millions of the human race. To name the kinds of bread on the market would fill a fairly large volume of itself. Biscuits are for the most part *unfermented* bread, and the simplest biscuit is made of flour and water with a pinch of salt only. Everyone knows now-a-days the vast number of firms making biscuits only. It is only in recent years that this industry has arisen. The bread of life is pre-eminently the loaf. The weight of the loaf is controlled by law. Directly the baker sells what is called fancy bread he is free from the law. Of course his object is to sell fancy bread. The price of cereal meal is from 1d. to 2d. per lb. Biscuits (fancy bread) are selling at 5d. to 10d. per lb., and the water in biscuits lessens the weight of wheaten flour used in them. Fancy bread is by no means essential to life.

The black bread of Germany is made of rye. On account of there being more gluten in rye than in most cereals it is made into fermented bread. It is an excellent bread, though much decried lately through ignorance. There are other devices to make the grains of the world into breads, but if these breads are leavened the meals have to be mixed with the requisite amount of wheaten flour to supply the gluten required. Thus, oatmeal, maize, rice, pulse, or peas-meal, Indian millet (the *dhoora* of Egypt), can be mixed with a proportion of wheaten flour to supply the gluten and made into very good leavened bread.

(4) *Oats and Oatmeal.*—Dr. Hutchison says this is "the most nutritious cereal." It is associated particularly with Scotland, where it forms, or did form, the staple bread of the country. Oatcake is baked in every house, especially country houses, in that land. In the towns they have long since begun to use wheaten bread, as in all towns all over the world. A favourite "bite" in Scotland for wayfarers is

oatcake covered with butter and then cheese; a more sustaining "bite" could scarcely be devised, as reference to analysis of the ingredients will show; moreover the flavour is delicious.

Oats are ground in the mill into meal; another method is by *rolling* the "groats," as we see in what is sold as "Quaker Oats." The flavour of Quaker Oats would lead one to believe that maize is freely mixed with the oats. If these grains are mixed the combination suffers hardly any disadvantage as a food. On a former page it is said that everyone should learn to make porridge. It is very simply made, and if well made the flavour is most pleasant and "nutty" as Dr. Russell, of Edinburgh, says. Take one to three teaspoonfuls of oatmeal to every pint of water, bring the water to the boil, whilst boiling and the pot still on the fire, take handful after handful of the meal and sprinkle in the water, stirring all the time with a special piece of wood made for the purpose called a "spurtle." Every man or woman in Scotland knows what a "spurtle" is. Every householder can make one with his pocket-knife; it should be of hard wood and shaped somewhat like a miniature oar. Of course the "spurtle" has no virtue in it, a wooden spoon will do as well; when all the meal is so used, the porridge is made. It should be boiled for half an hour ("eighteen minutes" one authority says), stirring it now and then with the spurtle left in the pot. It is a simple matter to add less or more meal if the porridge is not thick enough. A man doing hard work likes his porridge fairly thick. Salt should never be forgotten; it should have been mentioned first. It is put in the water with the first handful of meal; say a heaped teaspoonful to every pint, or say 80 grains to the pint. That dish with new milk is "food fit for the gods"; moreover children like it and they grow well on it. Children and adults are never known to get tired of it. Not only can porridge be made very palatable and pleasant, but it is known to be one of the best foods upon which the human race can be reared.

Table of analysis of meals on the market.

	Scotch	Irish	Quaker Oats	Carter's Oats	H.O.	Montgomery's Fine Oatmeal	Scott's Oatmeal Flour	Robinson's Groats
Water ...	5·0	5·0	7·8	3·1	9·0	6·3	5·8	10·4
Proteids ...	14·6	13·4	14·7	12·9	13·8	11·0	10·0	11·3
Fat ...	10·1	8·8	6·2	6·2	8·3	6·8	5·0	6·5
Carbohydrates and cellulose	68·2	70·1	69·8	76·0	67·2	74·2	77·9	70·4
Minerals ...	2·1	2·0	1·5	1·8	1·7	1·7	1·3	1·7

5. *Maize.*—This is the "staff of life" in Natal, South Africa, Ireland (since the potato disease) and the Americas. Maize compares favourably with other cereals. It is made into porridge by many nations, *e.g.*, Ireland (called "stirabout"), the United States (called "mush") in the Tyrol and North Italy, where it is mixed with cheese. When mixed with wheaten flour it makes good leavened bread (loaves) in the proportion of one-third flour to two-thirds maize meal. The Johnny and "Tortilla" cakes of North and South America are unleavened. "Pone" is a leavened bread made of maize meal. Hominy, cerealine, and samp are preparations of maize. Cornflour is widely known as a starchy preparation of maize for making blanc mange and other puddings. Maizena and oswego are preparations of maize when mixed generally with something else, such as eggs. Sugar corn is maize in the green state. Maize is of great nutritive value and economical for the toiling masses. There is more proteid in wheat, but more carbo-hydrates in maize. Maize is the richest of all cereals in fat.

(6) *Barley.*—There is a little gluten in

barley meal, and when mixed with half wheaten flour it makes good loaves. Barley meal is used in Scotland, Ireland, South England and Wales, also in Northern Europe. The crust of goose pie used to be a favourite dish made of barley meal. Pearl barley is always used in Scotch broth.

(7) *Rye.*—This is a most nutritious grain; we associate it chiefly with Germany. The "black bread" of northern Germany, known as pumpernickel, is very nutritious. Rye comes next to wheat in its supply of gluten (as previously noted), which enables it to be made into leavened bread.

(8) *Rice.*—Rice is poor in proteid and fat but rich in carbo-hydrate. Its character as a food rests on the great amount of starch it contains and the completeness of its absorption in the intestines owing to the smallness of the starch grains. It is a favourite for making puddings and frequently used with milk and eggs. It is the great food of the East generally. Rice is *universally used as the source of carbo-hydrates* and is a very popular grain.

(9) *Millet and Dhoora* (*Indian Millet*).—

This grain is freely used in Africa (Upper Nile), Southern Europe and China.

(10) Another cereal is *Buckwheat*, though not strictly a cereal, but a fagopyraceæ (another natural order), whilst the cereals belong to grasses. Buckwheat is freely used in Holland, Brittany and the United States, where it is made into porridge. It may be placed as a grain about midway between wheat and rice. It comes fourth of the grains for proteids and fat, and it has a large proportion of cellulose.

IX.—THE PULSES.

These consist of beans, peas, lentils and other varieties. They are called "poor man's beef" and are highly nutritious. A remarkable feature recently discovered is the power these plants have by nodules on their roots of abstracting nitrogen from the atmosphere and restoring virtues to the soil that has been impoverished by other crops. This is a noted advance in agriculture. The proteid in pulses is called legumin. It is rich in sulphur, potash, and lime, but poor in phosphorus and fat. Sulphur is apt—especially in beans—to produce flatulence of sulphuretted hydrogen. Pulses should be soaked in soft water, or if not soft, bi-carbonate of soda should be added ; this precipitates the lime in pulses. The pulses, on account of their poverty in fats, go well with such foods as fat bacon and fat meats. On account of the lime present it is said that people who partake largely of pulses get calcification of the arteries. The soaking it must be remembered is accompanied by a certain loss in proteids, minerals and carbohydrates, but also a loss of the bitter principle in pulses, which is objectionable to many people. Even with the disadvantages of the soaking process admitted, it is necessary to have the stronger varieties soaked, but the amount of soaking may be curtailed. Pulses form a most nutritious and economical food and should be used more freely than they are.

Revalenta Arabica is a valuable flour made of pulses, but possesses no advantages over ordinary lentil meal. Pease-meal is a favourite for making brose with boiling water and salt ; it is eaten like porridge with new milk—a capital food it is. Pulses are very thoroughly absorbed in the intestines. Valuable informa-

PULSES.

	Water	Proteids	Carbo-hydrates	Fat	Cellulose	Minerals	
Green peas	78·1	4·0	16·0	0·5	0·5	0·9	
Dried ,,	13·0	21·0	55·4	1·8	6·0	2·6	
Lentils	11·7	23·2	58·4	2·0	2·0	2·7	
Horse beans (dry)	13·1	25·5	50·9	1·7	5·5	3·3	
Broad ,, ,,	8·4	26·4	58·6	2·0	1·0	3·6	
French haricots verts	89·5	1·5	7·3	0·4	0·6	0·7	
,, ,, blancs	11·7	23·0	55·8	2·3	4·0	3·2	
Haricots (cooked)	73·6	4·4	20·8	0·5	—	0·7	
Scarlet runners	91·12	1·7	3·7	0·3	2·3	0·3	
Soy beans	11·0	32·9	28·7	18·1	4·4	4·9	
,, flour	9·3	39·5	28·2	13·7	4·0	5·3	
Peanuts	8·3	24·0	17·0	44·3	4·5	1·9	More like nuts.
Butter beans (ground, unpeeled)	10·5	20·6	62·6	2·0	—	4·3	
Revalenta Arabica	9·1	22·0	65·2	1·5	(?)	2·2	

tion can be gathered from the accompanying table of analysis. Explorers for the North and South Poles never fail to take amongst their foods plenty of meal made from the pulses, so valuable is it considered as a sustaining food in cold regions.

X.—ROOTS AND TUBERS (VEGETABLES.)

Roots and tubers are representatives of carbohydrates chiefly, and no doubt nature's intention is that the tubers should be stores of nourishment for the young plants, *e.g.* as seen in planting potatoes. The amount of proteids is very small, but salts are well represented. It is chiefly for the salts in roots and tubers that these are so valuable as foods. The potato is the most frequently used of all roots; it is a vegetable used daily, and very popular. At one time it must have been highly prized and thought to be a food capable of sustaining life, and to represent every kind of ingredient necessary. Time has revealed the fallacy of this supposition, and the potato famines in 1843-8 proved to those relying only on the potato as a food that it was insufficient of itself. Combined with some proteid it is still a favoured article of diet, *e.g.* potatoes and fish, or milk, &c. followed by oatcakes. This was a common diet amongst the Celtic races. That day is gone in some measure. One of the most important things to know about roots and vegetables generally is that cooking deprives them of a great part of their value by dissolving out the precious salts for which they are chiefly used. They should therefore most emphatically be steamed, not boiled in water. One of the best ways of cooking a potato is the old and proper method "in its skin." Now-a-days they are first peeled, then washed in water, and then boiled in water; and of course ruined as a vegetable.

Asparagin is a nitrogenous ingredient in the potato. There is reason to believe this substance prevents putrefaction in the intestines. a most useful office in vegetable diet. The *sweet potato* and *yam* are examples of potatoes in tropical lands.

Potato is a valuable antiscorbutic (Letheby in Hutchison). The turnip has scarcely any starch in it, and it may be eaten by diabetics,

TABLE OF ROOTS AND TUBERS.

	Water	Proteids	Carbohydrates	Fat	Cellulose	Ash	Extractives
Potatoes	76·7	1·2	19·1	0·1	0·6	0·9	1·4
,, (boiled in skins)	73·8	0·5	—	—	—	—	—
Carrots	83·7	0·5	10·1	0·3	1·5	0·9	1·0
,, (cooked)	93·4	0·53	3·39	0·17	1·8	0·14	—
Turnips	90·3	0·9	5·0	0·15	1·8	0·8	1·1
,, (cooked)	97·3	0·32	0·65	0·06	1·2	0·32	—
Radishes	90·8	1·4	4·6	0·1	—	0·7	—
Beetroot	83·9	0·5	11·0 10°/o sugar	0·1	3·0	0·9	1·0
,, (cooked)	94·8	0·44	2·83	0·06	1·3	0·3	—
Parsnips	80·1	1·4	14·1	1·0	2·1	0·13	—
,, (cooked)	97·3	0·22	1·46	0·29	0·72	0·12	—
Artichoke	79·8	2·3	14·5	0·3	2·0	1·0	—
,, (cooked)	91·6	1·8	4·6	0·08	0·9	0·61	—
Onions	89·1	1·6	6·3	0·3	2·0	0·6	—
Sweet potatoes	72·9	1·6	22·5	0·5	1·8	0·7	—
Yams	79·6	2·2	15·3	0·5	0·9	1·5	—
Tapioca (root)	11·0	—	87·5	—	—	—	—
Sago (a pith)	—	—	86·0	—	—	—	—
Arrowroot	16·5	—	82·5	—	—	—	—
Tous-le-mois	—	—	82·5	—	—	—	—

Salep (orchid root) ... The largest starch grain 82·5

Farina (English arrowroot), good and cheap, prepared from starch of maize, &c.

a fact worth knowing. The swede is more nutritive than the white turnip used at table.

Carrots are more nutritive than turnips, owing to their richness in sugar. The carrot is not very digestible, but valuable for its salts.

Beetroot is a valuable source of food owing to its sugar. Our garden beetroot contains as much sugar as the sugar beetroot, which contains 15°/₀ of sugar. The beetroot may be most valuable food for cattle, but most of its sugar is lost in cooking.

Parsnips may be classed as carrots, to which class they belong.

Artichokes may be taken by diabetics. They do not contain starch, but mucilage, and a carbohydrate named Inulin, the value of which is unknown. Onions have much cellulose in their composition, and are chiefly valuable as a flavouring agent, and are very popular.

Tapioca and its allies are very popular and highly digestible articles of diet. They are in daily use as foundations of puddings with proteid ingredients, as eggs and milk. They were so used before anything was known of their composition.

It should be repeated here that the salts and cellulose supplied by these roots are most valuable for health and vigour.

The amount of nutriment in green vegetables is very small. They are valuable additions for all that, but not for supplying the essential ingredients of food to the human body. They are rich in only one of these divisions, viz., salts. Everyone knows how valuable a supply of green vegetables is to the food. There is one ingredient they specially contain, that is cellulose, which forms a ballast for the bowels. That, with the supply of minerals, is their special use.

Oxalic acid is the acid in rhubarb: Citric acid is the acid in tomatoes. The former should be avoided in gravel, not the latter (Hutchison), as the amount of oxalic acid in tomatoes may be disregarded.

Constipation is one of the worst troubles of modern life, promoted chiefly by the fineness and daintiness of the food. Wholemeal bread is avoided by most people as if it were something detrimental to the body. Give them their choice—brown bread and plenty of green vegetables or the poison of constipation; most probably they will choose the poison!

XI.—COMPOSITION OF GREEN VEGETABLES.

	Water	Nitrogenous matter	Fat	Carbohydrates	Minerals	Cellulose	Fuel value per lb.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	
Cabbage	89·6	1·8	0·4	5·8	1·3	1·1	165 calories
„ (cooked)	97·4	0·6	0·1	0·4	0·13	1·3	—
Cauliflower (head)	90·7	2·2	0·4	4·7	0·8	1·2	175 calories
Sea kale	93·3	1·4	—	3·8	0·6	0·9	—
„ (cooked)	97·95	0·4	0·07	0·3	0·2	1·1	—
Spinach	90·6	2·5	0·5	3·8	1·7	0·9	120 calories
Vegetable marrow	94·8	0·6	0·2	2·6	0·5	1·3	—
„ (cooked)...	99·17	0·09	0·04	0·2	0·05	0·37	—
Brussels sprouts	93·7	1·5	0·1	3·4	1·3	—	95 calories
Tomatoes	91·9	1·3	0·2	5·0	0·7	1·1	105 „
„ (cooked)	94·07	1·0	0·2	0·1	0·76	1·5	—
Greens	82·9	3·8	0·9	8·9	3·5	—	275 calories

Green Vegetables—*continued*.

	Water	Nitrogenous matter	Fat	Carbohydrates	Minerals	Cellulose	Fuel value per lb.
Lettuce	94·1	1·4	0·4	2·6	1·0	0·5	105 calories
,, (cooked)	97·2	0·5	0·16	0·5	0·4	0·9	—
Leeks	91·8	1·2	0·5	5·8	0·7	—	150 calories
Celery	93·4	1·4	0·1	3·3	0·9	0·9	85 ,,
,, (cooked)	97·0	0·3	0·06	0·8	0·5	1·0	—
Turnip cabbage	87·1	2·6	0·2	7·1	1·5	1·3	145 ,,
Rhubarb	94·6	0·7	0·7	2·3	0·6	1·1	105 ,,
Macedoine (tinned)	93·1	1·4	—	4·5	1·0	—	110 ,,
Watercress	93·09	0·7	0·5	3·7	1·3	0·7	—
Cucumber	95·9	0·8	0·1	2·1	0·4	0·5	70 calories
,, (cooked)	97·4	0·5	0·02	0·7	0·2	0·9	—
Asparagus	91·7	2·2	0·2	2·9	0·9	2·1	110 calories
Salsify (cooked)	87·2	1·2	0·08	9·0	0·3	2·2	—
Endive	94·0	1·0	—	3·0	0·8	0·6	—
Savoy	87·0	3·3	0·7	6·0	1·6	1·2	—
Red cabbage	90·0	1·8	0·19	5·8	0·7	1·2	—
Sauer-kraut	91·0	1·4	0·7	2·8	1·7	0·9 1·26 acids	—

Cooking deprives all vegetables of most valuable salts, which are thrown away. When will people learn wisdom? All vegetables that can be eaten (of course they can all be steamed) in the raw state are 30 per cent. better than those cooked. All salads are most valuable, and are free from this objection. Salads should be used regularly, summer and winter. The more salads form a part of the daily food the healthier the population will be.

POWELL'S TABLE.

This is the best place to enter the impressions and general knowledge of minerals. In referring back to the chemical constituents of the body (Chapter I.), it appears there are 7 lb. of mineral matters in the human body. Lieutenant Powell gives a very useful table of the grains of the minerals in the various vegetable foods. It is here reproduced. That minerals are concerned in some of the most important functions of physiology seems to admit of no doubt, such as metabolism (p. 46). They have also valuable influences over certain diseases, such as gout, scurvy, purpura, gravel

Lieutenant Powell's Table.

Grains in 1 *lb. of Food.*

Foods (vegetables)	Total salts	Potassium oxide	Sodium oxide	Calcium oxide	Magnesium oxide	Iron oxide	Phosphate oxide	Sulphate oxide	Silicon oxide	Chlorine
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Stinging nettle ...	160·9	51·65	3·85	45·55	11·52	7·68	12·61	13·45	6.49	10·72
Spinach	146·0	24·50	51·50	17·36	9·32	4·89	14·98	10·65	5·60	9·06
Dandelion	133·0	51·80	13·89	26·53	11·14	1·14	10·42	2·98	9·33	3·52
French turnip	89·6	42·10	5·06	10·17	3·30	0·55	13·08	8·62	0·90	5·90
Cabbage	86·1	33·40	8·15	15·18	3·44	0·59	11·74	7·56	2·18	1·99
Leek	85·4	26·20	12·06	8·84	2·49	6·49	14·20	6·27	6·28	2·65
Topinambour	82·0	39·12	8·32	2·69	2·40	3·06	11·49	4·03	8·22	3·17
Cabbage turnip ...	81·9	28·90	5·35	8·97	5·50	2·48	17·92	7·25	2·03	4·06
Horse radish	75·1	16·49	2·82	6·59	2·65	0·87	30·85	5·79	6·13	3·69
Cabbage lettuce ...	72·1	27·15	5·43	10·56	5·46	3·76	6·62	2·71	5·86	5·52
Summer endive ...	68·5	17·32	24·19	8·12	2·97	0·86	7·46	2·65	2·05	2·87
Celery (stalk)	58·8	25·38	0·00	7·72	3·42	0·88	7·55	3·28	2·26	9·35
Potato	66·5	39·91	1·97	1·75	3·28	0·73	11·19	4·33	1·35	2·30
Carrot	63·0	23·31	13·30	7·15	2·76	0 64	8·12	4·06	1·50	2·89
Cauliflower	58·1	25·70	3·42	3·24	2·12	0·59	11·74	7·56	2·18	1·99
Lettuce...	55·3	25·40	5·21	3·34	1·20	0·00	4·71	2·15	11·19	2·62
Radish	51·8	16·57	10·89	7·73	1·63	1·47	5·62	3·34	0·47	4·73
Onion	49·6	16·90	1·26	11·35	2·31	1·15	8·61	2·82	4·22	1·20
Mushroom	49·0	24·92	0·81	0·49	1·65	0·79	16·50	1·96	0·48	0·43
Asparagus	37·8	9·25	6·45	4·10	1·63	1·28	7·01	2·34	3·78	2·24
Cucumber	27·3	11·22	2·74	1·99	1·13	0·38	5·46	1·89	2·19	1·80
Savoy cabbage ...	114·9	31·61	11·70	24·50	4·13	1·99	16·95	9·42	5·50	9·10

and bleeding from the gums. No definite knowledge is so far available about these things. We know that minerals are necessary for various physiological changes in metabolism, for minerals are intimate parts of the body, and therefore they must be supplied in the food. This table from Lieutenant Powell's book is an admirable one to supply the knowledge that one needs. It is known from the effects of saline medicines upon gout and rheumatic illnesses, that very probably in the natural salts in vegetable foods and their proper uses lie the prevention and cure of these maladies. The salines in vegetables, therefore (for they are natural foods), should be used with all the knowledge at one's command. No harm, or at most very little, can come of advising the regular and full use of vegetable foods. Reference is given chiefly to green vegetables, fruits of every kind, and that part of our foods generally understood by the term vegetables. This has nothing to do with vegetarianism, except the wisdom of using vegetables. There is no better way of using vegetables than in the form of salads—that is in the raw state. By this course we avoid that most destructive way British people have of cooking vegetables and throwing away the precious salts they contain.

XII.—FRUITS AND NUTS.

This is a class of foods that are highly prized, though the amount of nutrition in fruits is generally a small one. Nuts are exceptions to this assertion. Fruits contain examples of all the kinds of ingredients of food necessary for life. This is a statement that should be well known. The sugar is what is called lævulose, or fruit sugar. Cane sugar is also present in apricots, apples and pine-apple, a fact worth remembering in diabetics, lævulose being permissible to them. The proportion of sugar in fruit varies from 6 to 15 per cent. Fruits are eaten principally for the flavour, and not for their physiological necessity. The cellulose and minerals in them are most valuable to man. The flavour is due to æthers with sugars, combined with malic, citric, and tartaric acids. These acids in the blood combine with soda and render the alkalinity of the blood and urine more certain. The fruit-flavour bought in the shops is a product of coal-tar, of all sources the least likely! Fruits are classed as food or flavour foods according to the amount of water or solids—especially sugar—in them. The grape cure for plethora is a popular method, the patients themselves gathering the fruit and eating from 1 lb. to 8 lb. a day. The banana, figs, dates and raisins are used as foods. Referring to the analysis table one sees how valuable these are. Banana meal is about equal to rice in value. Two lb. of banana flour with 1 lb. of meat or fish make a sufficient allowance of food for a day to inhabitants of the Tropics. One half pound of dates with half a pint of milk forms an ample meal, or a pint of milk with 6 oz. of figs. A European arriving in the Tropics is struck with the small piece of land devoted to bananas that can supply enough for a large family.

No vegetable is so rich in fats as nuts. There are numerous preparations in the market of these fats, or vegetable butter, which are highly nutritious and economical. This fruit (nuts) is one of the sheet-anchors of the vegetarians, and rightly it is that should be so. As substitutes for butter these may be mentioned: albene, nucoline, vegetable suet, nut butter, cocoa butter, &c.

Nuts are indigestible and difficult to chew thoroughly; this difficulty is met by Fromm's extract, and the preparations sold by the Sanitas Nut Food Company. The chestnut and the almond are the most valuable perhaps of all our nuts. It is interesting to learn that in central France the peasants make two meals a day from chestnuts with milk. The almond is used to make diabetic bread on account of its poorness in carbohydrates.

Composition of Nuts.

	Water	Proteids	Fat	Carbohydrate	Cellulose	Minerals
Chestnuts (fresh)	35·5	6·6	8·0	45·2	—	1·7
Chestnuts (dried)	5·8	10·1	10·0	71·4	—	2·7
Walnuts (fresh)	44·5	12·0	31·6	9·4	0·8	1·7
Walnuts (dried)	4·6	15·6	62·6	7·4	7·8	2·0
Filberts and hazels	48·0	8·0	28·5	11·5	2·5	1.5
Filberts and hazels (dried)	3·7	14·9	66·4	9·7	3·2	1·8
Sweet almonds...	6·0	24·0	54·0	10·0	3·0	3·0
Pistachio nuts ...	7·4	21·7	51·1	14·0	2·5	3·3
Cocoa nut (fresh)	46·6	5·2	35·9	8·4	2·9	1·0
Cocoa nut (dried)	3·5	6·0	57·4	31·8	—	1·3
Cocoa milk ...	90·3	0·5	—	9·0	—	—

TABLE OF FRUITS.

	H.O.	Proteids	Ether extract	Carbohydrates	Ash	Cellulose	Acids
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Apple	82·5	0·4	0·5	12·5	0·4	2·7	1·0
" (dried) ...	36·2	1·4	3·0	49·1	1·8	4·9	3·6
Pears	83·9	0·4	0·6	11·5	0·4	3·1	0·1
Apricots ...	85·0	1.1	(?)	12·4	0·5	—	1·0
Peaches ...	88·8	0·5	0·2	5·8	0·6	3·4	0·7
Greengages ...	80·8	0·4	—	13·4	0·3	4·1	1·0
Plums	78·4	1·6	(?)	14·8	0·5	4·3	1·0
Nectarines ...	82·9	0·6	(?)	15·9	0·6	(?)	—
Cherries ...	84·0	0·8	0·8	00·8	0·6	3·8	1·0 to 1·5
Gooseberries ...	86·0	0·4	—	8·9	0·5	2·7	1·5
Currants (black and white)	85·2	0·4	—	7·9	0·5	4·6	1·4
Strawberries ...	89·1	1·0	0·5	6·3	0·7	2·2	1·1
Whortleberry ...	76·3	0·7	3·0	5·8	0·4	12·2	1·6
Blackberry ...	88·9	0·9	2·1	2·3	0·6	5·2	—
Raspberry ...	84·4	1·0	(?)	5·2	0·6	7·4	1·4
Cranberry ...	86·5	0·5	0·7	3·9	0·2	6·2	2·1
Mulberry ...	84·7	0·3	—	11·4	0·6	0·9	1·8
Grapes	79·0	1·0	1·0	15·5	0·5	2·5	0·5
Melons	59·8	0·7	0·3	7·6	0·6	1·0	—
Water melons ...	92·9	0·3	0·1	6·5	0·2	—	—
Bananas ...	74·0	1·5	0·7	22·9	0·9	0·2	—
Oranges... ...	86·7	0·9	0·6	8·7	0·6	1·5	1·0 to 2⅓
" juices ...	85·0	—	—	10·8	—	—	1·93

FRUIT TABLE—*continued.*

Lemons... ...	89·3	1·0	0·9	8·3	0·5	—	—
,, juices ...	90·0	—	—	2·0	0·4	—	7·0 citric.
Pineapple ...	89·3	0·4	0·3	9·7	0·3	—	—
Dates	20·8	4·4	2·1	65·7	1·5	5·5	—
Figs	20·0	5·5	0·9	62·8	2·3	7·3	1·2
,, (fresh) ...	79·1	1·5	—	18·8	0·6	—	—
Prunes	26·4	2·4	0·8	66·2	1·5	—	2·7
,, (fresh) ...	80·2	0·8	(?)	18·5	0·5	—	—
Currants ...	27·9	1·2	3·0	64·0	2·2	1·7	—
Raisins	14·0	2·5	4·7	74·7	4·1	—	—

	Sugar, per cent.
Hothouse grapes...	17·26
Preserved grapes	16·50
Figs	11·55
Cherries	10·00
Pears, fresh	8·78
,, preserved...	7·84
Currants, white	6·40
Strawberry	5·86
Apples, preserved	6·25
Raspberries	7·23
Oranges	8·58
Apricots	8·78
Pineapple	13·31
Plums	1·99
Lemons	1·47

XIII.—FUNGI, ALGÆ AND LICHENS.

Little is really known about these. Mushrooms are eaten occasionally, and people extol their virtues to the skies. The nutritive value is very low. They must be eaten for their flavour alone, for as said already, the amount of nourishment is trifling. There are, it is said, 1,400 species, including toadstools, in this country, of which 100 are edible. Thirty are said to be poisonous. There is an excellent chapter on fungi in Robert Hutchison's "Principles of Dietetics." Here is a table of analysis from that book.

Table of Composition of Fungi.

	Mushroom Per cent.	Chantrelle Per cent.	Truffle Per cent.	Edible boletus Per cent.	*Lactarius deliciosus* Per cent.
Moisture ...	93·7	90·93	73·0	84·19	89·08
Amides ...	1·3	0·64	1·4	2·6	0·91
Proteids ...	2·2	1·19	6·1	3·7	1·88
Fat	0·3	0·64	0·6	0·4	0·54
Carbohydrates	1·2	5·09	60·2	4·65	4·49
Cellulose ...	1·1	0·33	6·4	0·74	0·32
Minerals ...	0·3	1·20	2·0	—	—

Algæ and lichens, or Irish and Iceland moss, are not serious articles of food.

XIV.—SUGAR AND CONDIMENTS.

This is a most important division of our subject, on account of the high value of sugar as a food. Sugar was known in China; it is said to have been used there before it was used in Europe. From China the cane was cultivated in India first, then in North Africa, and then in the West Indies, which is associated in modern days with the cultivation of the sugar cane. In 1319 it is put on record in the accounts of the Chamberlain of Scotland that the price was 1s. 9½d. per lb. The use of sugar greatly increased in the fourteenth and fifteenth centuries. It was used chiefly first in medicine, hence the origin of the phrase, "Like an apothecary without sugar." Queen Elizabeth (1598) is said to have had her teeth black, "because the English were so fond of sugar."

There are several varieties of sugars in the market which are different in chemical characters, though close varieties of the same substance. These are the chief divisions:—

- I.—Sucroses
  - (1) Cane sugar.
  - (2) Beet ,,
  - (3) Maple ,,
  - (4) Maltose ,,
  - (5) Lactose ,,

II.—Glucoses
(1) Grape sugar (dextrose).
(2) Fruit ,, (lævulose).
(3) Honey ,, (a combination of the other two).

The terms used for *raw sugar* are "Barbadoes, Demerara and Clayed," which are varieties of the same thing depending on the mode of manufacture. In the process of refining the by-products, molasses, treacle and golden syrup are produced. *Barley sugar* is produced by heat, and *caramel* also by heat of a higher temperature.

	Molasses Per cent.	Treacle Per cent.	Golden syrup Per cent.	Honey Per cent.
Cane sugar ...	47·0	32·5	39·0	39·24
Fruit sugar ...	20·4	37·2	33·0	34·71
Extracts... ...	2·7	3·5	2·8	(?)
Salts	2·6	3·4	2·5	5·02
Water	27·3	23·4	(?)	19·98

The sucroses are examples of cane sugar and the glucoses are examples of invert sugar. A good example of invert sugar is honey. When jam is made with cane sugar the heat applied turns the cane sugar into invert sugar. The latter has a less sweetening effect on a tart than cane sugar; so if the sugar is added before cooking, as in the Scotch method, more sugar is needed than if added afterwards.

Generally invert sugar is made from cane or starch by the action of heat and acids. All sugars are converted into invert sugar in the stomach before absorption. It appears all sugars are converted into the form of glycogen before storage in the liver, and if more sugar is taken than can be successfully undertaken by the stomach and liver, the excess appears in the urine as if the person had diabetes, called in medical language "alimentary glycosuria." Thus it appears clear that there is a limit to man's power of taking sugar. Hutchison gives the amount as ¼ lb. daily.

There is little doubt sugar has been most useful to the human race since its universal introduction and use. It is found to be a very potent muscular invigorator. We have many experiments and experiences in support of this statement, *e.g.*, the Boers had a common practice in the South African War of carrying sugar-candy with them in the army.

Condiments and Spices.

To the healthy man these substances are not in the least necessary. In no sense can they rank as foods. On the other hand it is well known they are powerful aids to promote jaded and perverted appetite. They do not allow the natural appetite fair play, and they create a condition that constantly requires their own use. They should without hesitation be debarred from the use of the human race; this applies to all of them except those in common use. Mustard, pepper, commo salt and vinegar are on every one's table an these should be used with consideration They may be left, with this precaution, to th common sense of the individual. A very good substitute for the last, and moreover i is not liable to adulteration, is *lemon juice*.

XV.—WATER AND MINERAL WATERS.

This is a subject worthy of a division for itself on account of the importance of water for man's welfare. Every one should be alive to this necessity. About two-thirds of our bodies consist of water, and about one half of our food is made up of water. We give off 4½ pints of water every day. Every effort should be made, and it is so made by public bodies all over the Empire, to have the water we need pure. The sources of contamination are endless, and, as every one knows, medical officers of health are appointed in every town and county to protect the population from the dangers to health that may arise.

Water is not absorbed at all in the stomach. This fact is recorded in Hutchison's book. When we drink water it very soon rushes out of the stomach by the pylorus and is absorbed from the intestines.

The only trustworthy method of treating suspected water in the home is to have it well boiled. All other methods are too complicated for the ordinary household. If after boiling it has lost its palatableness, a good plan is to shake it up in a stoppered bottle or drop a sparklet or two in it to get it aerated (Sparklets process).

Those who are rich enough to indulge in the use of the host of mineral waters on the market can do so if they choose ; they are not by any means a necessity in life, though they may add to its pleasure. I refer my readers to the " Mineral Water Makers' Manual," quoted by Hutchison, or to this author, where a very comprehensive and useful article may be read on this subject.

XVI.—TEA, COFFEE AND COCOA.

These three beverages are universally used nowadays. This statement may at least be said of the first two, and cocoa in the form of chocolate is a favourite sweet and food. Tea is a very favourite stimulant among the English speaking race. In the British Isles 6 lbs. per head of the population are used annually; it is only in Australia that this amount is surpassed; it is said 9 lbs. per head are used there. In South Africa it is a common habit to present tea to visitors at any hour of the day, and this habit is not unknown in Scotland, though the great institution in the British Isles is afternoon tea. Giving tea to visitors, instead of the old injurious habit of the spirit "bottle" or some alcoholic stimulant, is a great improvement for the welfare of the people, for the injurious effect of tea is trifling compared with that of alcohol. This leads one to the making of tea. If tea is properly made any harm resulting from the use of the beverage is infinitesimal. The Chinese rule is that the water should be fresh drawn from a hill-running spring. This implies that it is full of air and it should be used immediately on boiling. A tea taster's strength is the weight of a new sixpence (43½ gr.) to 3½ oz. of water. This is somewhat less weight than that of the good old domestic rule "a teaspoonful for each person and one for the pot."

Coffee has never attained with us the same popularity that it has acquired on the Continent and in other nations. With us less than a pound per head is consumed annually, whilst in Holland it is 21 lb. per head of the population. It is commonly understood that the coffee in England is poor compared with that made on the Continent. The original home of coffee is Arabia, but it is grown now everywhere almost in tropical countries. The coffee fruit is about the size of a cherry and the stone corresponds with the coffee bean enclosed in a husk. Inside the husk is the coffee berry covered by a delicate skin; on this skin being removed there appears the berry in two divisions, face to face, which are "sorted" according to size. These should be freshly roasted and then ground. The roasting involves a loss of the chief ingredient, caffeine (21 per cent. loss) and of the fat (10 per cent.).

In the roasting also appears an oil, coffeol, to which the aroma of the coffee is due.

The "café au lait" consists of one part of coffee to three of boiling milk. Chicory, the root of the wild endive, is used as an adulterant of coffee; it is very much cheaper, and French coffee contains one third chicory. The rule for making good coffee is to use at least 2 oz. to the pint; the coffee freshly roasted and freshly ground, the water boiling, the grinder quite clean, and served quite hot.

Cocoa.—This substance, known in botany as the fruit of *Theobroma cacao*, was brought from Mexico by Columbus in 1520, something like 100 years before tea and coffee were used.

It is only in recent years, however, that it has come into general use and that chiefly through the enterprise of its manufacturers. The fruit resembles a cucumber with cocoa seeds embedded in the pulp; the seeds are about as large as haricot beans. When the pulp is removed by "sweating" and the seeds roasted, the husk is separated; then the two halves of the seeds appear, called *cocoa nibs.* These nibs are ground between hot rollers, which melt the fat they contain and reduce the cocoa to what is called a fluid condition—that is, a mixture of cocoa suspended in fat. The fat is removed by pressure and the cocoa is run into moulds. As it will be readily understood, there is no such thing as soluble cocoa, and various devices are adopted to suspend the cocoa in water.

Homœopathic Cocoa is a mixture of cocoa and arrowroot. *Navy Cocoa* is a mixture of cocoa and sugar.

The soluble form of that consists of 20 per cent. of sugar, 20 per cent. of arrowroot and the rest cocoa. Navy cocoa is thus a compound.

The chief alkaloid of cocoa is *theobromine*, which is closely allied to caffeine, and cocoa contains as much of its own alkaloid as coffee does of its, namely, about 1 to 2 per cent. Tannin is also an ingredient of cocoa. Starch is also present. The amounts of these vary according to the ways of preparing cocoa. Chocolate is a very favourite form of presenting cocoa to the public. In chocolate there is as much as 45 per cent. of sugar, and it is mixed with other starchy substances and very often flavoured. Chocolate creams consist of melted cane sugar and glucose largely.

Analysis of these Beverages.

	Black tea (Leaves) Per cent.	Coffee (Mocha raw) Per cent.	Cocoa (Inland Revenue) Per cent.	
Water	8·20	8·98	5·23	
Caffeine	3·24	1·08	0·84	(alkaloid)
Saccharose matter	—	9·55	—	
Caffeine acids ...	—	8·46	2·20	(cochineal red)
Nitrogenous and coloured matter	—	6·90	—	
Fat and oil ...	—	12·60	50·44	
Legumin ...	17·90	9·87	13·20	(albumins)
Dextrine ...	—	0·87	4·20	(starch)
Cellulose, &c. ...	34·0	37·97	6·40	
Ash	6·27	3·74	2·75	
Tannic acid ...	16·40	—	6·71	(astringent principles)
Chlorophyll, &c.	4·60	—	—	
Pectin, &c. ...	2·60	—	2·17	(gum)
Alcoholic extract	6·79	—	5·80	(un-named)
	100·00	100·02	99·94	

Tea, coffee and cocoa are very similar in action generally. Tea and coffee are pure stimulants and cocoa in theory is a food, but practically it is not. Cocoa in the form of chocolate, on account of its sugar and carbohydrates, is a valuable food and there are other convenient preparations of cocoa on the market that are more or less valuable as foods. Chocolate sweets are very popular. The beverage cocoa is preferred by some to tea or coffee, and when made with milk it is admitted as a preferable drink to either.

These three beverages are very fully and exhaustively described in Dr. Hutchison's Book on Foods.

XVII.—ALCOHOL, &c.

One of the best articles on this subject is that by Dr. Harry Campbell in the Book on "Diet, &c.," by various authors (Hodder & Stoughton, 1908). This writer represents the best attitude of the medical profession towards alcohol; any one going by his advice on the use of alcohol is pretty sure to keep on the right path. Dr. Harry Campbell is no friend to the man who would use "drink" in season and out of season. No more is the present writer, and he may add the same for, generally speaking, the whole medical profession in British lands. For a more powerful influence of the Church against alcohol, the position of a total abstainer seems a better one than that of one advocating temperance. The chief advantage of a temperance man over the total abstainer is one of freedom. One likes to have the freedom of taking alcohol or not taking it. That confers very little advantage, for it is well known that alcohol is well-nigh useless for a man in health. Put side by side with that, "that the total abstainer has the best of it," and it is difficult to see the gain to the advocate of temperance *versus* total abstinence.

Further, it may be stated in favour of total abstinence, that in health alcohol is useless for the purposes of nutrition. That is a fact that may be stated without hesitation in physiology. When healthy people at table partake of a stimulant we may take it that the benefit derived therefrom for the purposes of food is absolutely nothing, whilst the remote effects are not free from danger.

Alcohol is most valuable as a medicine. In health it is so dangerous that, like the Devil in "Paradise Lost," "farthest from him is best." Dr. Campbell says "alcohol has come to stay" (the more's the pity) and "we must make the best of it" (Campbell). It is a part of the medical man's profession to make himself conversant with its chief features, for daily—I may say daily—in his professional work he comes in contact with some feature of the effects of alcohol. What proportion of a doctor's work is due to the effects of "drink" is incredibly high. We spend £166,000,000 (one hundred and sixty-six millions) every year on our drink bill! We have to spend on paupers in the four divisions of the British Isles some £16,000,000. It cannot be said that the spending of 166 millions is useless, but it is quite certain all the amount spent on "drink" is not necessary for life, whilst the harm it does is enormous, and the misery and ruin it brings to many homes are everywhere conspicuous.

Alcohol is made by fermentation from sugar and starch. It has much affinity for water. The strongest form of alcohol is known as rectified spirits of wine, and contains about 9 per cent. of water. Absolute alcohol even contains 1 to 2 per cent. of water. Proof spirit which is used in pharmacy chiefly has 49·5 of alcohol. Brandy distilled from wine contains from 50 to 60 per cent. of alcohol. All drinks owe their stimulating effect to the amount of alcohol they contain. In the table of analysis of the stimulants used in the British Isles it will be seen that upon the amount of alcohol they contain depends to a great extent their quality. As medicines, their use is regulated by the percentage of alcohol they contain. Alcohol has a stimulating effect on the heart, and when given in the right cases it is said that there is nothing to equal it for its stimulating effect, and that it has saved many lives. The cases are few where such a condition can be verified, though the fact must be admitted. It has also a beneficial effect in moderate doses on digestion. Further than that it would be difficult to say anything in its favour. Generally speaking the effect of alcohol is deleterious. Many of the human race take alcohol in some form or other, much to the disadvantage of health, and in many cases life is shortened by its use.

Table of Percentages of Alcohol by Volume in the More Common Stimulants.

Rum	43	per cent.
Whisky	43	,,
Brandy	43	,,
Gin	37	,,
Port	25	,,
Sherry	21	,,
Champagne	10 to 15	,,
Hock	10	,,
Claret	9	,,
Beer	7	,,
Lager Beer	4	,,

The question of the use of stimulants or stimulating drinks by the human race is a very grave one, and the writer is so prejudiced against their so-called benefits, that he thinks nothing short of total abstinence is likely to be helpful to man. Writers on alcohol, at least all thoughtful writers, even when they sanction the guarded use of stimulants, hem their sanction round with so many precautions, on account of the dangers that accompany the use of alcohol, that it is clear to any one the only safe course is to avoid its use altogether. It should be said that all the stimulants mentioned vary very much from each other on account of the many bye-products present as well as the alcoholic strength in the stimulants. The wines have numerous bye-products and it is to these their bouquet and flavour are chiefly due.

In addition to these ordinary stimulants there are on the market, as everyone knows, numerous liqueurs (at very high prices), of alcoholic strength about equal to brandy, but nobody is mad enough to recommend *them.*

The cider and perry makers strive to make their products of as weak alcoholic strength as possible consistent with the proper preservation of these fluids for keeping purposes.

So with beer-making, the weaker it is in alcohol the better. Every total abstainer in the land is glad to hear of any drink substitute without the alcohol and there are many of them sold. We do all we can to present people with pure water and that is the only—the only—quencher of thirst in the wide world. It is cheap enough, can be had anywhere for the asking. Moreover, it supplies the whole of man's necessity in the fluid line.

XVIII.—TEMPERATURE.

The heat of the body has not hitherto been spoken about. This is a most remarkable phenomenon of life, and the warmth of the body is such an everyday affair that hardly a thought is given to it. The temperature of the body is about 98·4° F., and the food we eat acts precisely as a fuel to maintain the heat at that degree so long as the body is in health. Other animals also have a temperature somewhere about 100° F. (some higher, some lower than the heat in man), and birds are warmer still. They all maintain the heat of their bodies by their food acting, as in the case of man, as a fuel. Our bodies are machines and every one knows how much the life of a machine depends on the usage given to it. One man uses his gig, or carriage, or motor with reason, another man recklessly and without reason. So it is precisely in the case of our bodies. It is supposed that Providence will send a "disease of death" and that man cannot help it. This is quite true, but not invariably true. Over and above this misfortune in Nature (which, by the way, is dependent very often on man's ignorance, and the misfortune is yearly becoming more amenable to man's own control), the broad question holds good that the life of man is in his own hands. This has only an indirect bearing on the question of heat of the body, which is a profound question in Nature. The food is the fuel. But fuel will not burn without oxygen. Whence does the body get its oxygen? It is within the knowledge of everyone that the oxygen we need is derived from the air we breathe. Oxygen is therefore a food, for without its regular supply the food we eat would not burn, or, as we say in physiology, get oxydized. This oxygen is carried by our arterial blood to every region of the body and there in the cells of our organs oxydizes all the food we take. Oxygenization, or burning, does not take place without the production of heat. We say frequently that food warms us, and one is well aware of the sense of warmth after food. Until the nineteenth century this was not tested by thermometer, for that instrument was not practically used until a time within the memory of men now living. The writer well remembers the physician placing his hand on the patient's skin to judge of his heat. No doctor now trusts to that, he puts the thermometer to work. Food is therefore fire. Where does food get that ability to act as a fuel? The reply is, from the heat of the sun. To explain further this point one would need to bring in the science contained in "Conservation of energy." Suffice it to say that the sun confers on all foods certain potential (capable of power) powers that can be produced when required and when the necessary conditions are supplied. Food is fuel; coal is fuel. These have similarly received their power from that immense ball of fire in our universe.

From a great number of experiments and from the burning of the different foods in a calorimeter (heat measure), it is found that in protein each gramme requires to be multiplied by 4·1 to give its fuel value; similarly fat multiplied by 9·3 gives the full value of fat, carbohydrate multiplied by 4·1 = its fuel value. The fuel values are termed calories. The word means heat. One has to know the number of grammes of proteids, fats and carbohydrates in the diet and multiply by 4·1 in the case of proteids and carbohydrates and by 9·3 in the case of fats and the calories are easily found.

XIX.—THE COOKING OF FOODS.

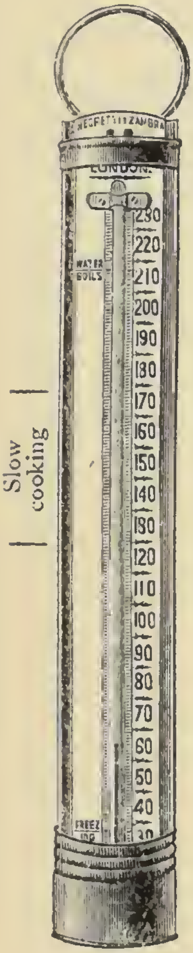
Every person in the land knows, as he thinks, everything about cooking foods! It is difficult, therefore, to say anything that is thought necessary on such a subject. When one thinks of cooks and the ignorance some of them display in our kitchens, then he begins to realize the big business before him who has the audacity to say anything about cookery. Moreover one knows how difficult it is to teach anything to those that go about thinking themselves perfect. It is impossible! Nevertheless there are people in the world who are ever ready to learn. For these, one may confidently assert, there are many things yet to learn about cooking foods.

The following remarks are not intended for anything beyond the general principles of applying heat to nutritive products. Certainly it would be bold to presume to say anything pertaining to the technique of the kitchen.

Why do we cook food at all?

It is found now that meats of all kinds are more easily digested if eaten in the raw state. This is a fact now admitted by everybody who has any authority on the question. The essences of proteids, the great source of which is flesh of all kinds, are for the most part in a fluid state in nature. The effect of heat on proteids is to coagulate them. The very general impression formerly prevailed that cooking could not be accomplished without the full blast of high temperature at the boiling point. This is by thermometer 212° F. It is found now that long before the temperature of

212° F. is reached all proteids are coagulated. All that is necessary is to apply a temperature of 170° F., and all proteids are then coagulated. Any temperature above that spoils them by hardening and shrinking them, and rendering them more indigestible. This temperature all cooks should learn how to test, and they should act accordingly. They should be taught how



Thermometer as used in large braising pots, as for cooking a ham. Range of temperature from 30° to 220° F., so as to safely cover the boiling point 212° when required. The usual range for "slow cooking" is marked on the scale as lying between 130° and 175°. Its length is 8 in., not reckoning the ring at the upper end. Smaller instruments can be bought from Negretti and Zambra, London, for use in small saucepans, &c.

to use a thermometer or thermometers. "Rule of thumb" is good if there are brains behind it, but it is not enough; "put machinery on to it." That is the remedy; test the heat. Probably if the cook had this instrument shown to her she would readily use it. We do not hear of a thermometer ever being used in our kitchens. Well! how can cooks use thermometers if they have never been told how? That is the case with proteids.

Carbohydrates are pretty much under the same influence in the matter of that as proteids. That is to say it is not necessary to apply to them any higher heat than to secure the cellulose and starch to be broken up, so as to be made more digestible by the action of the digestive juices. It is found by experiment ("Sykes on Brewing,") that our object ought to be to apply such heat that the starch of the cereals should be turned into gelatine. The effect of heat on starches or carbohydrates is to cause them to swell and burst through the coatings of the cellulose. When once that is effected the office of the heat is accomplished, and if it is necessary to continue the effect any longer care should be taken that the temperature should not go higher than 180° F., or so high as it is found necessary for the temperature to go to secure that all cereals are gelatinized. This is the very highest heat necessary. A high heat in the case of carbohydrates is not, however, so detrimental in the case of the starches as it is in proteids.

The sugars are also frequently cooked, as we see in the case of tarts and puddings, when we unwittingly cook them. In fact it is said that all sugars are not assimilated until first converted into a substance (invert sugar) suitable for that purpose. Here one may refer to "barley sugar" as we see in dried raisins and caramel, both of which conditions of cane sugar are produced by different degrees of heat.

Fat, which is also not injured by high temperature, as proteid is, is very often changed in cooking, but fat allowed to cool again from being thoroughly cooked becomes granular and easily digested, as for example we see in dripping and fried bacon.

1. *Boiling.*—One object of boiling meat is to give it a brown or cooked appearance. This is attained at a temperature of 175° F. and a temperature above that only renders the

proteids more indigestible. The other object in boiling meat is to preserve the juices and extractives and thereby preserve the flavouring which is so valuable for the palate. One way of doing this, and the best, is to place the meat for a few minutes into quite boiling water and then lower the temperature and cook slowly. Of course, if the object of the boiling is to get a valuable soup or broth, a different procedure is followed—a high temperature all the time and let the salts and extractives flow into the water, *e.g.*, Scotch broth.

Try these principles in cooking an egg and you will be surprised at the difference. Let the egg be cooked in water with a temperature of 175° F. for ten to fifteen minutes and then try it.

2. *Simmering.*—Simmering is supposed to take place at a lower temperature than boiling, This is an error. Simmering is slow boiling, and they both take place at a temperature of 212° F.

3. *Roasting.*—This takes place when a piece of raw meat is placed near enough the fire to receive the heat by direct radiation. Cooking of a joint of meat is done in front of the

fire. Cooking of a chop or steak is done on a gridiron, over the fire. As in the case of boiling it is well to get the surfaces sealed up as soon as possible and then let the cooking be finished in a lower temperature. This is on purpose to preserve the extractives and salts in the meat itself. Of course, the flavour is preserved at the same time. It is well to remember that as soon as the raw appearance disappears the meat is cooked and no advantage is gained by prolonging the operation.

Desiccation is prevented by continuous basting, which consists of pouring a coat of dissolved fat over the cooking joint. A dark brown sticky substance of a very sapid nature develops over the cooking surface. It goes by the name of *osmazone* and is familiar to everyone.

The dumpy chop. This is a sign of skilful cooking. The chop is first put near the heat of a fierce fire, so as to seal up the surfaces for the purpose of retaining the juices and extractives *in* the chop. This is the cause of the dumpiness. When the surfaces are sealed a lower heat is all that is necessary to complete the cooking (175° F.).

4. *Baking* is done in the oven and is the same as roasting.

5. *Stewing.*—This is the ideal method of cooking meat. There is no danger of the salts and extractives being lost here. We all know what a favourite Irish stew is. Here again slow cooking is the road to success. Potatoes nearly always alone is the vegetable in Irish stew, but there is no reason, but the reverse, why other vegetables should not be added to the stew, for here certainly all the salts of everything are preserved. The temperature should never be allowed to rise above 180° F. The *bain-marie* of the French is recommended for stewing.

The Cooking of Fish.—The proteids and salts of fish are preserved in the same way as in the case of flesh. A sudden high temperature applied to the surface to seal up the outside of the fish, and then finish the cooking in a lower heat. Boiling fish is very apt to be done at the loss of much of the extractives and salts. Unless it is skilfully done other methods should be adopted. It is better to rely on *steaming* the fish, which is a very palatable way of cooking it and soon acquired by any one.

The other method usually adopted is frying the fish in an oil bath. The temperature should be 350° to 390° F. and there should be plenty of oil. Very high temperature is required here. When the temperature is high enough the fish is cooked as soon as the sputtering which always takes place ceases. The sputtering is caused by the moisture on the fish going off in the form of steam. The old-fashioned way of frying fish is a kind of roasting in a frying pan.

Here are put on record comparatively new methods of cooking by leading men who have given this subject much thought. These methods are especially valuable in cooking vegetables, though they can be used with much advantage in proteids also. Reference is made to the glue-pot style of cooking-pot, or double pot method. The French *bain-marie* is constructed on this plan. The method is described in Sir Hy. Thompson's "Food and Feeding," page 96. Warren's cooking-pot and Bailey's cookers are on the same principle (10, Bromley Road, Beckenham, Kent). The *Duplex Boilerette* (R. W. Wellbeck, Banbury) is a modification of a similar plan. Another most valuable apparatus goes by the name of the Norwegian Self-acting Cooker. This consists also of a double pot. Suppose we want to cook a fowl, we are asked to put the fowl for a few minutes (eight or ten) in an ordinary pot over the fire with boiling water to seal up the outside layer of the meat. Then place the fowl in the inner vessel of the Norwegian double pot and let it go on cooking slowly in a low temperature for eighteen to twenty hours. The fowl is said to come out of that tender and perfectly cooked. One object of the Norwegian apparatus is to prevent the waste of coal that is such a lamentable feature in our kitchen ranges. Canon Moore Ede's apparatus for "cheap food and cheap dinners" can be obtained from Messrs. Emley of Newcastle, and the book on the methods from Walter Scott, publisher, London. One more method is that invented by Dr. Edward Atkinson, called the "Aladdin Oven." It is reported on most favourably by Mesdames Richards and Abel, from America: "for simplicity, effective use of heat, economy of fuel, development of flavour, increase of digestibility, the Aladdin Oven exceeds in merit any other apparatus in the market." No apology is needed for giving the addresses of all these excellent plans of cooking and saving fuel.

There is the cooking of the vegetable yet remaining. To cook these in water (boiling water) and then throw the water away is to ruin the purposes for which they are intended. The same may be said about all succulent roots, and particularly about potatoes. These last should either be steamed or cooked in the old-fashioned way, "in their jackets." Surely the proper way to cook all green vegetables and roots is to steam them. *Any* cooking is sure to deprive vegetables and roots of a share of their precious salts for which they are solely prized and valued. An exception in this statement should be made to the splendid methods of cooking, viz., stewing and Scotch broth. These are by far the safest methods we possess. The water in stewing, and of course in Scotch broth, is meant for consumption, and the more of the juices of the meat and vegetables dissolved in the water the better. But it is high time, in this twentieth century, that boiling of vegetables and then throwing the water away should be a thing of the past.

Salads, on the other hand, afford no outlet for being spoiled in this way. They cannot be too highly commended. We ought to take a lesson from the French in salads. Every one who values health, and the preservation of health, should be familiar with the uses of vegetable salts for these purposes. We wait till the evil day comes, and then douche the body with saline medicines for our diseases whilst we have thrown away the precious salts of our green vegetables that nature provides to preserve our health. It may be hereby declared that no one need be ill as a broad rule. That is a bold statement that is, generally speaking, perfectly true. Of course there are the diseases that surpass the wit of man to discover the causes thereof, but there are numerous others that man brings about by his own doings, or by his own neglect. It is hereby believed implicitly that man's use of foods generally, and his misuse of vegetables particularly, are in many cases the potent causes of man's own diseases. What are those diseases, asks the enquiring mind? Here is a list of them for the guidance of those who enquire:— Biliousness, indigestion, quinsy, tonsilitis, rheumatism, gout, headache, constipation and its train of maladies, liver and kidney diseases, and many more that ought to be recorded. Common sense will reveal our failures, for they are as numerous as leaves in a wood (Vallombrosa). The list of diseases here given is from the distinguished physician and author, Dr. Pavy, and the writer gives his adherence to the list as being a fair one, and not exaggerated in the least.

XX.—THE STANDARD DIETS.

This must have given food for thought to many in ages gone by. In the history of the world we more often hear of the scarcity of food than of its superabundance. It is only within the memory of men now living that the profuseness of foods all over the world has opened the eyes of men to consider if, after all, there may be an error in the amount of food that people consumed. It is true that many thinking men here and there have spoken against the errors of the human race in the matter of food and diet, but these were isolated instances and never held as a general belief.

Nations take time to give the question enough thought, or to take any decided action. Years and years ago this question of the amount of food kept here and there gaining ground. Diseases in the meantime are getting more numerous, and investigators of disease and scientists kept discovering causes of maladies about which there could be now no doubt. Few ventured to launch out as it were against food as being a cause. Physiologists could not have the audacity to say that the amount of food men consumed could, in the face of a general history of scarcity, be thought a cause of any ill-health. They gathered facts, and found the Standards of Diet all the world over did not vary very much. All these Standards of Diet have, without exception, been founded on instinct and habit. Man ate what he thought was a fair amount for his needs, and on these amounts Standards of Diet were founded. These standards were accepted as being the just amounts man should have before him. At last, after every known leader on the subject of Foods had expressed his opinion, that the tendency of man was to take too much food, if not the actual fact; a scientist has arisen in the person of Chittenden, of Yale University, who attempted to put the question on a scientific basis. This man, Dr. Chittenden, is Professor of Physiology in Yale University, and Director of the Scientific School there. He induced five men, including himself, of the staff of Yale, to put themselves under his guidance, which they willingly did, and they were under strict rules of diet for from six to eighteen months. They were all trained men, and they knew very well what they were about. The summary of the results is so valuable that it shall be here given word for word :—

"A healthy man whose occupation is such as not to involve excessive muscular work, but whose activity is mainly mental rather than physical, though by no means excluding the latter, can live on a much smaller amount of proteid or albuminous food than is usually considered essential for life, without loss of mental or physical strength and vigour, and with maintenance of body and nitrogen equilibrium. This means that the ordinary professional man who leads an active and even strenuous life with its burden of care and responsibility, need not clog his system and inhibit his power for work by the ingestion of any such quantities of proteid food as the ordinary dietetic standards call for. There is no real physiological need, that is apparent, for the adoption of such dietetic habits as ordinarily prevail, or as are called for by the dietary standards set by most authorities in this branch of physiology. There is no justifiable ground for the dictum, or the assumption, that the adult man of average body-weight needs daily 118 grm. of proteid food for the 'maintenance of health, strength and vigour, or that there is need for the metabolism of at least 16 grm. of nitrogen daily.' If such were the case, how could these five subjects, whose experiences have been detailed in the foregoing pages, have maintained their body-weight, established nitrogen equilibrium, pursued their ordinary avocations without loss of strength and vigour, and kept in a perpetual condition of good health with an average daily metabolism of from 5·4 grm. of nitrogen to 8·99 grm. of nitrogen, for periods ranging from six to eighteen months? Surely if 16 to 18 grm. of nitrogen are a daily requisite for the healthy adult, there should have been some sign of nitrogen starvation during these long periods of low proteid diet, but the sharpest scrutiny failed to find it. On the contrary, there were not wanting signs of improved condition of the body which could not well be associated with anything but the changes in diet."

"With this general concurrence of results we are certainly warranted in the assertion that the professional man can safely practise a physiological economy in the use of proteid food equal to a saving of one-half to two-thirds the amount called for by existing dietary standards, and this without increasing the amount of non-nitrogenous food consumed."

Dr. Chittenden further experimented with twenty men, volunteers from the United States Army. The chief points in the experiments are the following:—

From various reasons, chiefly on account of incompatibility for the purposes of the experiment, the number of the men was ultimately reduced to thirteen, but being of different nationalities they were generally admirably suited for the purposes of the experiments, and being soldiers, they were accustomed to obey; and besides, they loyally threw themselves into the faithful carrying out of the details of the diet and of the experiments. They continued under Professor Chittenden's directions for about six months. They were, though under rules as to the amount of food, at perfect liberty to eat the kind of food they liked best. Here are Dr. Chittenden's general conclusions:—

"There is no need for a daily diet of 118 grm. of proteid food; this is clearly indicated. These soldiers lived without discomfort for a period of five months on amounts of proteid food not more than one-half that called for by the ordinary standard dietaries, and this without increasing the amount of non-nitrogenous food. Body-weight, nitrogen equilibrium, physical strength and vigour, ability to respond to sensory stimulation, the general condition of the blood all remained unimpaired under a daily diet involving the metabolism of only 7 to 8 grm. per day. The neuro-muscular machinery was improved so much as to be noticed by the men themselves, and by the test of the dynamometer, &c. It is enough here to emphasize the fact, that with a greatly diminished proteid metabolism the body suffers no harm, and there seems no adequate reason why the body should be cumbered with such quantities of proteid food as are considered necessary for health and strength."

Professor Chittenden regrets that he has no facts to present as to the value of these results on the question of disease. He has, however, the impression, that as the men were all free from all ailments whilst under his care and under the experiments, there was no tendency to disease. Further, he states that when a person once experiences the advantages sufficiently long of a diet lessened in proteid matter, he has no desire to return to the diet rich in proteids. He prints a letter from one of the soldiers written in July following the experiments, in which the soldier, John B. Steltz, says, "The men eat very little meat now."

Dr. Chittenden further experimented with eight athletes, members of Yale University. These men, being trained athletes and accustomed to full proteid diet, presented different questions to the other groups. The rule is that athletes are supposed to need a high proteid diet and it is universally conceded that they, of all others, need a continuation of this high proteid food, for it is believed that that is the foundation of their success in athletics. It was, therefore, questionable how far a reduction of their proteids was permissible. They, therefore, proceeded with caution. During the first ten days or so of the experiments the men did not reduce their proteids. They continued under the rules necessary for the success of the experiments for about five months. After ten days on their old diets they began to lessen the proteid food. Here are Professor Chittenden's conclusions :—

"It is quite evident from a study of these results that young vigorous men can satisfy all the true physiological needs of their bodies and maintain their strength and vigour, as well as their capacity for mental work, with an amount of proteid food equal to one-half or one-third of that ordinarily consumed by men of this stamp. These men reduced the proteid food to 8·8 grm. of nitrogen per day, equal to a metabolism of 55 grm. of proteid food per day. In other words these athletes were able to reduce their nitrogenous metabolism to as low a level as the other groups with not only the maintenance of health and strength, but with a decided increase in their muscular power."

The impression made upon the present writer leaves no room to doubt the excellency of the reasoning and plan adopted in Chittenden's book. The surprise is that there should be some men in England who can see any exception possible to such a wise, careful, reasonable, and scientific procedure. To the writer's mind there is not a shadow of doubt about the truth of the contention in question. All medical men with rare exceptions agree that the men and women who can afford it consume too much food. Even lay people have the impression that the general public, as a broad rule, indulge too freely in the good things of the table.

Examples of the standards in the countries of Europe and in America have been before people and leaders of thought in this branch of physiology for ages past. No doubt these diets were very thoroughly investigated by the best physiologists living, but the authorities of the present day are inclined to the belief that the real foundation of these standards was man's own inclination, founded on man's appetite and man's consumption of foods in the twenty-four hours. The histories of these distinguished authorities from whom are gathered these standards are not all known, but there is little or no doubt they are worthy of every possible consideration, and should be given every reasonable and fair judgment.

Standard Diets.

	Proteid Grm.	Fat Grm.	Carbo-hydrate Grm.
Voit Carl (Germany) ...	118	56	500
Moleschott	130	40	550
Rauke (Germany)	100	100	240
Forster (England)	131	68	404
Hultgren and another (Sweden) ...	134	70	523
Eriswan (Russia)	113	79	583
Atwater (U.S.A.)	125	125	400
Hirschfeldt (Germany) ...	105	63	541
Lichtenfelt (Italy)	110	—	—
Swedes at hard work ...	189	110	714
Gautier (France)	110	68	423
Nakahanea (Japan) ...	85	(Fat and carbo-hydrates omitted).	

There never arose any doubt about these standards being high enough. The impression prevailing nowadays is that the amounts are too high.

XXI.—THE METRIC SYSTEM

(HOW TO CHANGE INTO).

English people understand grains better than grams. Fifteen grains and a-half in each gram. Voit's standard is, as a rule, taken as an example where plenty of food is never of any doubt; 118 grm. of proteid multiplied by 15½ amount to 1,829 grains; 437½ gr. in an ounce; 118 grm. would be somewhat over 4 oz. Four ounces of meat would be a reasonable allowance. We shall have frequently to use these weights as we go on.

On the other hand, in contradistinction to these standards, Dr. Pavy, a leading man in the medical profession a generation ago and happily spared to us yet, gives examples of people living on a very low diet for years with success. For instance, he gives Thomas Wood, the miller of Billericay, in Essex, reported to the College of Physicians by Sir George Baker in 1767. This man sustained for eighteen years a remarkable degree of vigour on 16 oz. of flour, with no other nutriment, made into pudding with water, and no other liquid of any kind being taken. Sixteen ounces of flour represent: 1·72 oz. proteid; 0·32 oz. fat; 11·28 oz. carbohydrates (437·5 gr. in the ounce and 15·5 gr. in 1 grm.); therefore, 1·72 oz. at 437·5 gr. equals 51 grm. of proteid, &c.:—

Thomas Wood: 51 grm. proteid, 9 grm. fat, 318 grm. carbohydrates. Voit's standard, 118 grm. proteid, 56 grm. fat, 500 grm. carbohydrates. Proportion in Wood's case: one-half proteid, one-sixth fat, about two-thirds carbohydrates.

This shows the comparison. The miller of Billericay must have been an exceptional man, but there is no doubt it was quite possible for him to do what Dr. Pavy relates.

Dr. Pavy relates another example: Cornaro, a Venetian noble, who lived in the fifteenth and sixteenth centuries. He lived till he was 100 years old. Convinced at 40 that a man requires less food as he gets older, in opposition to the generally received opinion that then man needs more to compensate for his failing powers, he resolved on a new course of life after having led a life of indulgence in eating and drinking (Dr. Pavy's book, p. 467). This man had a feeble constitution. Besides many disorders he was afflicted "with melancholy hatred and violent passions, which appear to have the greatest influence over our bodies. I perceived in a few days that the course agreed with me very well, and in less than a year entirely freed me from my complaints. What with bread, meat, the yolk of an egg and soup, I ate as much as weighed in all 12 oz., neither more nor less. I drank but 14 oz. of wine suited to my stomach." He delivered discourses on living when he was 83, 86, 91 and 95, and these discourses were given with vivacity and vigour. These were translated from Italian in 1768 and created much enthusiasm at the time.

Dr. Pavy further relates the middle diet at Guy's Hospital. He himself was Physician of the Hospital at the time. This is the general diet given in the wards. It is stated in the Avoirdupois weight, which is very good, as the weighing is known and understood and perfectly correct. It is useless for comparison with the weights in the Metric system. In that system as formerly stated the foods are spoken of as proteids, fats, carbohydrates, salines and water. It seems to be taken as understood what is proteid, what is fat and so on, instead of giving the ordinary name of the food, such as peas, brose, bread, codfish, and so on. It would be a great advantage to the population in general if they really knew what they were eating. They do know that flesh is flesh, and that flesh is the principal food for man, but what they do require is a more particular knowledge what the virtue of any food is. How will they learn that? By looking at and learning the analysis of the different kinds of food. No one expects everybody to know everything, but it is something to understand that *they do not know.* When people begin to see that, the road to success is sure. In the following pages, an endeavour is made to show how the English foods and the English weights are rendered into the Metric weights and measures. The first thing to learn is the percentages. Take as an example a certain grain or cereal. The percentage of this or that ingredient in it is the first thing that reveals its worth as a food. Look, for instance, at rye: The percentages in rye are :—

Water	Proteid	Fat	Carbohydrates	Salines
15·0	8·0	2	73·2	1·8 = 100·0

That reveals precisely what the value of rye is as a food. What is a carbohydrate? It is a starch, and so on with others. People talk of percentages as if everyone knew that. It is not so certain that everybody knows that. At all events, percentages are a part of the Metric system. It is high time the Metric system was introduced into the British Isles. It is all over Europe, all over the New World, and England alone abides by the old weights and measures.

Take the diet at Guy's Hospital, or what the diet was in 1874 :—

Bread	12 oz.
Meat	4 ,,
Potatoes	8 ,,
Butter	1 ,,
(Milk 2½ oz. milk for rice pudding, say 5 oz., milk for tea ½ oz.) therefore say :—	
Milk	8 ,,
(Sugar, ¾ oz., sugar for tea, sugar for rice pudding, say in all)—	
Sugar	1½ ,,
Stout	½ pint.

It is called in Dr. Pavy's book 29½ oz. in solids, and we may accept that as correct.

How to get that diet into the Metric system? Write it along the horizontal for convenience and reduce the ounces in each case to grains, also for convenience, as from grains the metric weights are easily got at.

Diet in Guy's Hospital in 1874.

	Bread 12 oz.	Meat 4 oz.	Potatoes 8 oz.	Butter 1 oz.	Milk 8 oz.	Rice pudding 1 oz.	Sugar 1½ oz.	Porter 10 oz.
In grains	5250·0	1750·0	3500·0	437·5	3500·0	437·5	656·25	4375·00
Water	2100·0	1328·25	2684·5	4069·0	3010·0	230·56	14·37	3893·75
Proteids...	341·25	321·3	42·0	5·69	143·5	21·88	0·0	14·44
Fat	52·5	15·75	3·5	361·81	136·5	0·44	0·0	152·49
Carbohydrates	2688·0	0·0	675·5	0·0	182·0	183·31	633·5	300·56
Salines	68·25	84·7	94·5	29 31	28·0	1·31	8·33	13·56
In grains	5250·00	1750·0	3500·0	437·5	3500·0	437·50	656·20	4375·00

Bread	Meat	Potatoes	Butter	Milk	Pudding	Sugar	Porter	Tea
oz.	oz.	oz.	oz.	oz.	oz.	oz.	pint	oz.
12	4	8	1	8	3½	1	½	¼

In grains, 437·5 gr. in an ounce, and 15·5 gr. in 1 grm.

						Rice			
Oz.	12	4	8	1	8	1	1½	10	¼
	‖	‖	‖	‖	‖	‖	‖	‖	‖
Gr.	5,250	1,750	3,500	437·5	3,500	437·5	656·25	4,375	—

Disregard the tea.

So far, we see the grains are the same in amount at the top and bottom of this table. What we have to do is to divide the amounts at the top on each column into the five divisions named at the side. Take 12 oz. of bread for instance, we have to divide 12 oz. or 5,250 gr. into five divisions in proportion to the percentages of the five nutrients in bread. No matter what the food may be, it cannot contain any greater number of nutrients than those mentioned at the left side. In order to divide, for example, the 12 ounces of bread into water, proteid, fat, carbohydrates, and salines, it is necessary to have percentage tables of all the foods given at Guy's. This is essential. Then let us look at the table for bread. It is found that bread (white bread) is composed of water 40, proteid 6·5, fat 1·0, carbohydrates 51·2, salines 1·3 per cent. = 100 parts. If one multiplies each of these percentages in turn, *e.g.* by 40, by 6·5, by 1·0, by 51·2 and by 1·3 by the number of grains or weight of food to be divided, and divide by 100, that gives the proper divisions of the weight of food among the nutrients mentioned on the left side. That is the way the above table is produced. Similarly any diet promulgated *anywhere* can be divided into tables like the above.

Summing up the amounts of water, proteids, fats, &c., in the Guy's Hospital diet, we shall know at a glance how much of each nutrient is supplied to the patients each day, thus (p. 162):—

Water ...	Total sum	13302·12	(omit water)			
Proteids ...	,,	980·12	÷ 15½	=	57·4 grm.	*51 grm.
Fats	,,	722·99	,, ,,	=	46·6 ,,	* 9 ,,
Carbohydrates	,,	4662·87	,, ,,	=	300·8 ,,	*318 ,,
Salines ...	,,	327·96	,, ,,	=	21·16 ,,	
		19906·06				
Sum of figures along the bottom		19906·2				

* The Miller of Billericay.

Compare this with the Standard Diets on p. 156. These are the amounts advised by the staff at Guy's, and we may rely upon it the diet was right, for the doctors at Guy's had no interest whatever but one, and that was to keep the patients comfortable.

XXII.—WEIGHING OF FOODS.

Whatever may be done in institutions where numbers of inmates may be living, such as asylums, workhouses, prisons, and hospitals, &c., the question becomes a different one when the private family is concerned. The private family has been, for the last six thousand years or more, trusting to what we call instinct in the matter of the amount of food man ought to take. Writers, nowadays, have learned from the history of ages the amount of food men and women ought to have per day, and they have constructed tables from this knowledge founded on past experience, and this is the guidance of the human race through instinct, as it is called. Man is said to have an *instinct* to guide him in the matter of food, but in everything else he is said to use his *reason.* Instinct is what we are taught in books to be an attribute to guide the lower animals. In this one point alone has man pointed to instinct as his guide. In recent years, the amount of food required by the race is controlled or checked by *reason*, or in other words, "weights and measures." That is to say, there has arisen a different school of thought from the one hitherto trusted as a safe one for the amount of food required. Mankind has had an impression for years that something was wrong with the race in the matter of food. If one asks an intelligent general reader to-day his or her opinion on foods the answer as a rule is, "Well, I have not thought much about it, except that I know we are having too much." This is from an actual conversation with the writer. That is an accepted fact by the general reader. It can very safely be asserted that medical men support, in the great majority of instances, this impression. Here is a list of diseases brought about from excess of food, from the great Dr. Pavy, who is a distinguished doctor and author of a past generation (1874), pp. 9 and 158.

One is tempted to quote what Dr. Pavy says further on the "Proper amount of food." "The proper amount of food required depends upon the existing circumstances. No fixed quantity can be given as suited to all cases. Variations in external temperature, the amount of work performed, and individual peculiarities occasion a variation in the amount of material consumed in the body, and in a properly arranged diet the food should be adjusted accordingly. For this adjustment Nature has provided by the instinct or sensation with which we are endowed. Appetite, or in its more exalted state, hunger, apprizes us that food is required and produces an irresistible desire to seek and obtain its supply. By attending to its dictates a knowledge is also afforded of the proper amount to be consumed. We may ascertain by observation the precise amount by weight that is necessary to keep the body in a properly nourished condition, but Nature's guide was in operation before weights and scales were invented. Speaking of the natural state, it is only where the strict margin on the score of economy, as in feeding large bodies of men, has to be regarded that a process of weighing need be employed. Appetite as a guide in regulating the supply of food must not be confounded with a desire to gratify the palate. When food is not eaten too quickly and the diet is simple, a timely warning is afforded by the sense of satisfaction experienced as soon as enough has been taken. The stomach often refuses this point to be far exceeded. With a variety of food and food of an agreeable character to the taste the case is different. Satiated with *one article* the stomach is ready for *another*, and thus for the *gratification of taste* and not for the *appeasement of appetite* men are tempted to consume *far more* than is required and also often far more than is *advantageous to health.* The dictates of appetite should be obeyed. Sometimes, as noticed by Europeans visiting the tropics, appetite falls off; this is then often counteracted by having recourse to condiments of a stimulative nature to the stomach. This is clearly an error, and one which is calculated to lead to baneful results, as in other instances where Nature's indications are disregarded in favour of artificial devices."

Dr. Pavy then gives tables of the amounts of food required according to different authorities.

First of all he gives the weight of his own diet, and we may depend upon it he did not over-state the facts. He tells us he is 10 stones in weight, and 5ft. 9ins. (rather over) high. His diet was of the usual admixture of meat and vegetables, and the diet was weighed in the state in which it is placed on the table. "8 oz. for breakfast, 6 oz. for luncheon, and

16 oz. for dinner. This amount gives me the outside of what I feel I require."

Dr. J. B. Thomson, on prison diet in Scotland in 1863, says :—

1 oz. of meat per day (or fish one day in seven) made into soup with vegetables.

20 ozs. milk (skimmed) or butter milk.

? Oatmeal or barley bread.

Health uniformly good ; 88 per cent. maintained or gained weight.

Dr. Guy (1863) in English prisons.—"We have conclusive evidence of the sufficiency of a diet from which meat is wholly excluded and even of a diet consisting wholly of vegetable matter."

XXIII.—PRESENT DAY DIETS.

Diet A.

For Prisoners confined for not more than Seven Days.

This diet is by order of the Government and we may rely on its being thought out carefully. The diet consists of bread 24 ounces, 2 pints of gruel, made with 2 ounces of oatmeal to the pint, and 8 ounces of potatoes

That is all. Extending these out in the Metric system we have :—(*See* pp. 161-164).

Proteid	63·2	grm.
Fat	18·4	,,
Carbohydrates	464·0	,,
Salines	20·7	,,
	566·3	,,

Diet B.

Prisoners when confined for not more than four months.

Diet: Bread 22 oz., gruel 1 pt., potatoes 8 oz., beef 4 oz., porridge 1 pint. (*See* pp. 161-164).

Proteid	84·4	grm.
Fat	21·7	,,
Carbohydrates	453·4	,,
Salines	27·0	,,
	586·5	,,

Diet C.

In Convict Prison (*Males*).

Bread 22 oz., meat 5 oz., potatoes 12 oz., porridge 1 pint, cocoa $\frac{3}{4}$ oz., sugar $\frac{3}{4}$ oz., milk 2 oz., salt provided. (*See* pp. 161-164).

Proteid	89·44	grm.
Fat	23·9	,,
Carbohydrates	471·4	,,
Salines	30·2	,,
	614·94	,,

Derby Borough Asylum (Men Patients).

Diet on a Thursday: Bread 19 oz., butter 1 oz., meat 4 oz., vegetables 16 oz., pudding 10 oz., sugar 1 oz., milk $22\frac{2}{5}$ oz. (pudding day), tea 1 pint, coffee 1 pint. (*See* pp. 161-164).

Proteid	92·11	grm.
Fat	57·0	,,
Carbohydrates	369·0	,,
Salines	30·74	,,
	548·85	,,

Derby Borough Asylum (Attendants).

Diet of attendants: Bread 20 oz., meat 12 oz., vegetables 16 oz., milk 1 pint, tea $\frac{1}{2}$ oz., coffee $\frac{1}{2}$ oz., butter $1\frac{1}{7}$ oz., sugar $2\frac{2}{7}$ oz., cheese $1\frac{1}{7}$ oz., bacon $2\frac{2}{7}$ oz., preserve $\frac{4}{7}$ oz. (*See* pp. 161-164).

Proteid	146	grm.
Fat	107	,,
Carbohydrates	411	,,
Salines	51	,,
	715	,,

The Asylum at Stone, Bucks (Patients).

Diet: Bread 20 oz., butter 1 oz., tea 2 pints, sugar 1 oz., milk 2 oz., meat 8 oz., vegetables 12 oz. (*See* pp. 161-164).

Proteid	88·08	grm.
Fat	37·70	,,
Carbohydrates	340·33	,,
Salines	29·32	,,
	495·43	,,

Diet for Attendants at Stone Asylum.

Diet: Bread 20 oz., butter $1\frac{1}{7}$ oz., meat 16 oz., tea and coffee, bacon $2\frac{2}{7}$ oz., sugar $2\frac{2}{7}$ oz., flour $2\frac{2}{7}$ oz., cheese $2\frac{2}{7}$ oz., milk $\frac{1}{2}$ pint, suet $\frac{1}{2}$ oz., jam $1\frac{1}{7}$ oz. (*See* pp. 161-164).

Proteid	171·0	grm.
Fat	110·7	,,
Carbohydrates	446·0	,,
Salines	54·0	,,
	781·7	,,

AYLESBURY UNION.

(1) *Ordinary Diet for Men.*

Diet: Bread 18 oz., meat $4\frac{1}{2}$ oz., vegetables 12 oz., milk 20 oz., gruel 1 pint, oatmeal $1\frac{1}{2}$ oz. (*See* pp. 161-164).

Proteid	97·95	grm.
Fat	38·14	,,
Carbohydrates	364·25	,,
Salines	29·8	,,
	530·14	,,

(2) *Infirm Diet* (*Men*).

Diet: Bread 24 oz., meat 4$\frac{1}{2}$ oz., vegetables 12 oz., cocoa $\frac{1}{2}$ oz., tea $\frac{1}{2}$ oz., cheese 1$\frac{1}{2}$ oz., butter 1 oz., milk 3 oz., sugar 1 oz. (*See* pp. 161-164).

Proteid	94·17 grm.
Fat	47·05 ,,
Carbohydrates	484·81 ,,
Salines	29·3 ,,
	655·33 ,,

(3) *Attendants.*

Diet: Bread 16 oz., flour 2$\frac{2}{7}$ oz., meat 16 oz., potatoes 16 oz., tea $\frac{1}{2}$ oz., butter 1$\frac{1}{7}$ oz., sugar 2$\frac{2}{7}$ oz., cheese 1$\frac{1}{7}$ oz., beer 2 pints. (*See* pp. 161-164).

Proteid	167·7 grm.
Fat	145·7 ,,
Carbohydrates	536·2 ,,
Salines	56·1 ,,
	905·7 ,,

Summary.

	Proteid Grm.	Fat Grm.	Carbohydrates Grm.	Page
Voit's standard ...	118·0	56·0	500·0	... 156
The miller of Billericay	51·0	9·0	318·0	... 157
Cornaro (a Venetian who lived in 1500)...	—	—	—	... 158

Guy's Hospital in 1874	57·4	46·6	300·8	161
Prisoners' diet A	63·2	18·4	464·0	170
,, ,, B	84·4	21·7	453·0	170
,, ,, C	89·44	23·9	471·0	170
Borough Asylum, Derby—				
Men patients	92·11	57·0	369·0	171
Attendants	146·0	107·0	411·0	171
Bucks Asylum, Stone—				
(1) Patients	88·0	37·0	340·3	171
(2) Attendants	171·0	110·7	445·0	172
Aylesbury Union—				
(1) Ordinary diet	97·9	38·14	364·25	172
(2) Infirm ,,	94·17	47·05	481·8	173
(3) Attendants	167·7	145·7	536·2	173

XXIV.—HABIT.

"Habit is to us a kind of second nature!" This is a line of words once set in a "copy book" at school. The words were never forgotten, though they have pretty well been neglected in practice. In physiology there never were truer words—that is, in the matter of food and drink. Every one is aware of the force of habit in what work he may have to do. The repetition of any work becomes in practice an easy affair. On the present occasion "habit" is considered entirely with reference to food and drink. It is a most certain fact that what we are accustomed to in food and drink that is the food or drink we in our life enjoy. There is no greater wonder in physiology than the fact that man all the world over can live on so varied a diet: the Chinaman or Indian on his rice, the Italian on his polenta, the South Sea Islander on his cocoa-nut, are equally content and happy. Amongst our own people of the British Isles, it is almost incredible with what amount of relish the food is enjoyed, to which men and women are trained to live on in their younger days. The infant equally enjoys his porridge and milk as the hoary-headed grandfather, simply because of "habit."

No wonder then that habit is so important in life, and in order to get the habit strong, a beginning should be made early. Youth is the time to form habit. It is not surprising that people are anxious about training the young to form careful habits and avoid fanciful dishes.

It is said that the stomach can be trained to any kind of food. This is a discovery of the most skilful physiologists, and there is scarcely any doubt of its being a correct view. It is not the coarseness of a food that does the harm and brings the woes of indigestion, but the sweets and fineness of the dishes. Amongst the well-to-do, "parties" are ruinous for the mischief they bring in their train.

One has only to mention the habit of taking alcohol as one to prove the stomach can be trained to tolerating and liking any kind of food. At first when alcohol is tasted it is naturally turned away from in disgust. No doubt it is a poison, and at first it is treated as such. One would suppose a liking for the nauseous drug would never take place. Yet we know that it is liked or even craved for by many, and millions of precious money spent uselessly for the most part in its pursuit.

In youth the appetite is so strong that it is not easy to upset it, hence the persistence of the impression that one need not take such care as doctors are so fond of saying. It is quite true that there is a great margin to allow one to make free frequently with fancy dishes and fancy bread. But it is also true that fancy dishes and fancy breads make the worst sort of health for the man or woman or child who indulges in them. There is reason to think that no class shows a lack of wisdom in this so much as that from which our public schools and the old English universities draw their populations. They seem to exist chiefly for what they can eat and drink. The public cater for these. Shops with fancy bread for sale are legion in number; sweet cakes and sweet bread proclaim on every hand that they know their wares will be bought, and they must have plenty ready for the foolish who "are seen coming." It should be proclaimed with all power that the fancy bread and fancy sweets make a very much less healthy individual than the plain ordinary food on which the poor have to live. This does not mean any lessening of good food and good cooking for those who can afford these, but the broad fact remains that the plainer the food the healthier and stronger the individual is. Does all this mean less disease? —Undoubtedly. Disease is getting less every year. Knowledge of disease is daily extending everywhere (see Dr. Pavy's list of diseases man brings on himself, p. 9). People talk of disease as a dispensation of Providence. It is perfectly admissible that this may be true at the present day, but it is also abundantly certain that it is much less true to-day than it ever was before. Moreover the statement is getting every year less true. Alas, when man does his share, and uses his strong claim for lessening the incidence of disease, it will be much less on the human race. The statements herein on habit are facts, and it is no hardship on youths to be trained to eat ordinary foods, for we know that they will like them for ever afterwards. It is sufficient to have drawn attention to this certain fact in physiology for those who wish to learn and help towards a safer method of feeding. For those who do not clutch at such aids it is hoped that wiser counsels will prevail as years roll on.

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